AVIATION WEEK

A McGRAW-HILL PUBLICATION

April 9, 1956 50 Cents

Fairchild C-123 Gives USAF Wings To Army GI

The Anti-Missile Missile: Is Effective ICBM Defense Possible?

Let Freedom Ring!

From the moment the *spirit of '76* was born with the *shot heard 'round the world* and proclaimed with the ringing of the Liberty Bell . . . sounds have played a vital part in our American freedom!

Today, the freedom of every man, woman and child of this nation is inseparably linked with another sound – the protective roar of great new jet aircraft like Convair's delta-wing supersonic F-102A all-weather Interceptor.

The modern minutemen of the U.S.A.F. Air Defense Command who fly these jet aircraft for your protection never relax their vigil. *Let Freedom Ring!*

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

FOR 3000 PSI PNEUMATIC SYSTEMS

SOLENOID VALVES
REGULATORS
INTERLOCK VALVES

Stratos' Western Branch now is turning out solenoid valves and pressure regulators for 3000 psi pneumatic systems. Light, reliable, precision-built, they complement the large group of Stratos pneumatic equipment for aircraft.

Model 7008 solenoid valve assembly

Exploded view of Model 7006 solenoid valve core, assembly and body

Model 7009 solenoid valve core

Photos not to scale

Solenoid valves are made in two types, each produced as: normally closed, normally open, and normally closed with manual override. Designed for continuous duty in aircraft pneumatic systems, Stratos 3000 psi solenoid valves are compact, light, and simple to install. Drawing less than 1 amp, they are fast acting (0.020 sec.) and their reliable performance remains unaffected by temperatures of −65°F to over 165°F.

Flow capacities are equivalent to a 0.040" sharp edge orifice for the direct-operated size and to 0.312" for the larger air relay type. The solenoid of the smaller model is used in the higher-flow air relay unit.

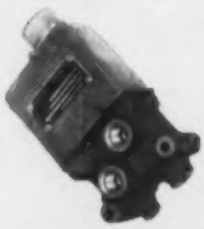
Both types are available as either complete units—or as core and seat assemblies which can be threaded into housings integral with the mechanism to be controlled.

Model 7002 pressure regulator

Pneumatic Pressure Regulators by Stratos provide a wide range of adjustable downstream pressures and are designed to operate with 3000 psi supply.

The high flow model, with a flow capacity equivalent to a .115 diameter sharp edge orifice, can be adjusted to downstream pressures from 400 to 1500 psi. Downstream proof on this pilot operated unit is 5000 psi.

The poppet-type, medium flow regulator illustrated delivers a capacity equivalent to a .035 diameter sharp edge orifice, adjustable downstream pressures range from 100 to 800 psi., proof pressure is 1500 psi.



INTERLOCK VALVE
pneumatic/electric

Pressure: Rated 400 to 1500 psi. Proof 3000 psi. Burst 4000 psi.
Control: Mechanical. Interlock switch rating at 30 V dc or 250 V ac is 10 amps.
Weight: 1.2 pounds
Ambient temperature range: −60°F to 165°F.

Provides pneumatic and electrical interlock to prevent premature energization of devices in series with actuator of interlock valve.

For more complete data on Stratos' 3000 psi solenoid valves and pressure regulators, write to: Stratos' Western Branch: 1800 Rosecrans Avenue, Manhattan Beach, California

Stratos Western Branch also makes:

ACTUATORS · COMPRESSORS · EJECTORS · CONTROLS

STRATOS

A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION

Main Plant: Bay Shore, L.I., N.Y. Western Branch: 1800 Rosecrans Ave., Manhattan Beach, Calif. West Coast Office: 1355 Westwood Blvd., Los Angeles, Calif.

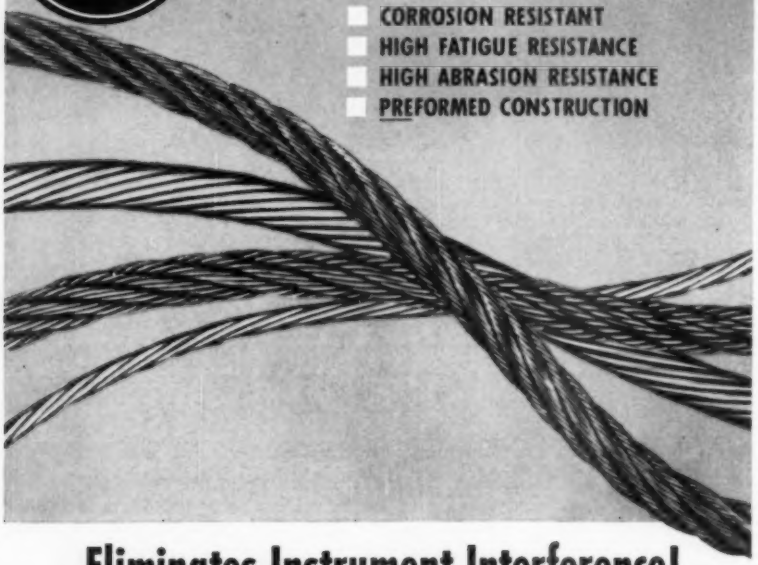
Accessory systems and precision equipment for aircraft

NEW "NO-MAG"

ACCO products

NON-MAGNETIC AIRCRAFT CABLES

- GOOD THERMAL CHARACTERISTICS
- CORROSION RESISTANT
- HIGH FATIGUE RESISTANCE
- HIGH ABRASION RESISTANCE
- PREFORMED CONSTRUCTION



Eliminates Instrument Interference!

• Just as we expected, many aircraft designers were interested in the recent announcement of our new non-magnetic aircraft cable. If you did not see it, "NO-MAG" has these characteristics:

NON-MAGNETIC PROPERTIES... "NO-MAG" cable is made from type 305 stainless steel. It remains non-magnetic after severe cold working—in contrast to standard stainless steel aircraft cable which shows a pronounced increase in magnetism after swaging, wire drawing or similar operations.

This non-magnetic property of "NO-MAG" cable eliminates instrument interference from cable magnetism.

CORROSION RESISTANCE... New "NO-MAG" cables have corrosion-resistant qualities similar to, but slightly better than, cables made of standard stainless steel.

GOOD THERMAL CHARACTERISTICS... The thermal expansion characteristics of new "NO-MAG" cable are much closer than those of standard stainless steel or carbon steel cables to the characteristics of aluminum alloys used in aircraft. This greatly simplifies maintaining cable tension under various changes in temperature.

HIGH FATIGUE RESISTANCE... Preformed construction and careful processing give new "NO-MAG" cable high fatigue resistance.

HIGH ABRASION RESISTANCE... New "NO-MAG" cable shows greater abrasion resistance than standard stainless steel aircraft cables.

TENSILE STRENGTH, while lower than that of stainless and carbon steel, is sufficient to enable replacing these, size for size, with "NO-MAG" on many applications where the characteristics of "NO-MAG" are required.

USE WITH SWAGED TERMINALS... Swaged terminals can be applied to standard AN dimensions.

COMPLETE RANGE OF SIZES, CONSTRUCTIONS... New "NO-MAG" is furnished in sizes from 1/16" to 1" in all of the standard aircraft cable constructions.

Get the complete story on this new technical development for the aircraft industry. Write today to Detroit office.

ACCO

TRADE MARK

Automotive and Aircraft Division
AMERICAN CHAIN & CABLE

601 Stephenson Building, Detroit 2
2216 So. Garfield Ave., Los Angeles 22 • Bridgeport 2, Conn.

Aircraft Cable • Swaged Fittings

AVIATION CALENDAR

Apr. 15-19—Airport Operations Council, 9th annual conference, Hotel Warwick, Philadelphia.

Apr. 16-18—Aero Medical Assn., annual meeting, Drake Hotel, Chicago.

Apr. 16-18—American Society of Mechanical Engineers, First Gas Turbine Power Conference, Hotel Statler, Washington.

Apr. 18-19—First Annual National Industrial Research Conference, Armour Research Foundation, Hotel Sherman, Chicago.

Apr. 19-20—Annual Meeting of the Science Section of the Environment Equipment Institute, Sheraton Hotel, Chicago.

Apr. 22-25—American Association of Airport Executives, 29th annual convention, Hotel Carter, Cleveland, Ohio.

Apr. 26—Institute of Navigation, annual regional meeting, Friendship International Airport, Baltimore, Md.

Apr. 26-27—Aeronautical Training Society, annual meeting, Mayflower Hotel, Washington, D. C.

Apr. 26-27—11th Annual Management Engineering Conference, Society for Advancement of Management-American Society of Mechanical Engineers, Hotel Statler, New York.

Apr. 26-27—Institute of the Aeronautical Sciences Southeastern Student Conference, Georgia Institute of Technology, Atlanta, Georgia. **May 3-4**—Sixth Annual West Coast Student Conference, Los Angeles.

Apr. 30-May 4—Society of Aeronautical Weight Engineers, 15th national conference, El Cortez Hotel, San Diego.

May 1-3—Annual Electronics Components Symposium, Dept. of Interior Auditorium, Wash., D. C., sponsored by American Institute of Electrical Engineers, Institute of Radio Engineers, Radio-Electronic-Television Manufacturers Assn. and West Coast Electronic Manufacturers Assn.

May 2-3—Air Traffic Conference of the Air Transport Assn., spring meeting, Hotel Radisson, Minneapolis, Minn.

May 6-9—Second Annual Symposium on Flight Test Instrumentation, sponsored by Instrument Society of America, Bell Aircraft Corp., Convair and Temco Aircraft Corp., Hotel Texas, Fort Worth.

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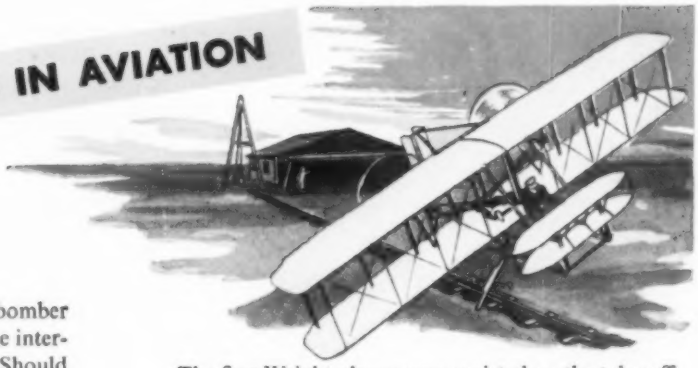
Phillips 66
PRESENTS

MILESTONES IN AVIATION



Smallest Airport

The experiment of an Air Force jet fighter-bomber leaping into the air from a truck reveals some interesting developments in future air combat. Should large forward airfields be knocked out, it will still be possible to give troops close air support or to carry out other fighter-bomber missions.

The fighter is launched from a heavy truck hooked to a caterpillar tractor. The truck is equipped with a launching device used to launch the Martin *Matador* guided missile. The truck can be taken to any spot and when a mission is ordered, the pilot "entrucks," runs his jet engine at full speed, sets off a "booster bottle"—and the plane takes off.

The first Wright planes were assisted on the take-off by a launching device. The plane was attached to a cable. The cable ran through pulleys and was hooked to a heavy weight, suspended in a tripod mast. When the weight was dropped, the plane was shot forward into the air.

It's Performance that Counts!

As a pioneer performer in research and manufacturing to meet aviation needs, Phillips Petroleum Company took an active part in the early, crucial setting up of standards for aviation fuels and lubricants. Indeed, Phillips has led the way in the production of many of the major ingredients of aviation gasolines.

Today, Phillips Petroleum Company has the highest yield of aviation gasoline per barrel of crude oil processed.

In aircraft fuels, it's *performance* that counts. And military and commercial operators know they get *super* performance from Phillips *66* products.

AVIATION DIVISION
PHILLIPS PETROLEUM COMPANY
BARTLESVILLE, OKLAHOMA

Phillips 66

AVIATION PRODUCTS

READY FOR OUTER SPACE...

The missile that can fly right out of this world is no longer years away.

AC is working now with top scientists and engineers, translating dreams and theory into electronic circuits capable of directing missiles to the outer reaches of space.

AC stands in the very front lines of progress with an enviable record of outstanding successes in electro-mechanical research, engineering and production.

AC is ready now – not tomorrow, but today!

THE ELECTRONICS DIVISION AC OF GENERAL MOTORS

A FEW OF THE new

VICKERS

AIRBORNE HYDRAULIC VALVES

from New "Concept-through-Production" Facility at El Segundo Division

The valves shown are representative of an expanding line being built to meet rapidly advancing airborne requirements. They were developed in close cooperation with the airframe and power plant engineers who are using them. They are products of Vickers El Segundo (California) Division, which has complete engineering, laboratory and production facilities for "concept-through-production" of airborne hydraulic valves.

Thoroughly experienced in the requirements of aircraft systems and working closely with the Detroit organization, the El Segundo staff can quickly solve new problems in design. As soon as the prototype is approved, it becomes a production item in minimum time. Ask the nearest Vickers Application Engineer for further information or write for Bulletin A-5209.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

ADMINISTRATIVE and ENGINEERING CENTER

Department 1400 • Detroit 32, Michigan

Application Engineering and Service Offices:

El Segundo, California, 2160 E. Imperial Highway • Arlington, Texas, P.O. Box 213 • Detroit 32, Michigan, 1400 Oakman Blvd. • Washington 5, D. C., 624-7 Wyatt Bldg. • *Additional Service facilities at:* Miami Springs, Florida, 641 De Soto Drive

TELEGRAMS: Vickers WUX Detroit • TELETYPE "TWX" DE89
CABLE: Videt, Detroit

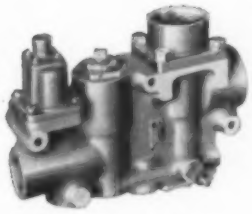
Overseas Representative: The Sperry Gyroscope Co. Ltd.—Greatwest Road, Brentford, Middx. England

Hydraulic Motor with Anti-Overrun Flow Control

Constant Gain Nose Wheel Steering Valve

Flow-Sensitive Pressure Regulator

Motor with Constant Speed Valve

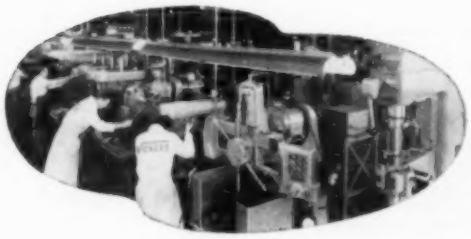


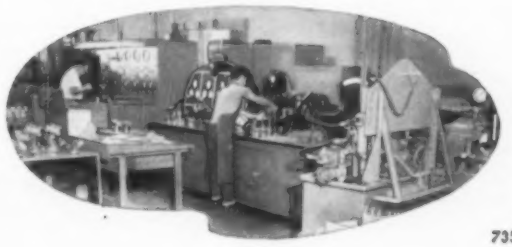
Pump Control Valve

Relief Valve with Thermal Protection

Power Control Flow Regulator

Design, Development, Testing and Manufacturing at El Segundo Division of Vickers Incorporated.





7352

Top photo shows missile tank constructed of two forged and machined end caps and center section of tubing. Middle photo shows assembled tank. The *Uniwelds* are located in the approximate center of the bright machined bands. Bottom photo shows a tank that has been pressured to bursting with 2½ times normal operating pressure. Note that the split crosses both weld planes with no tendency to divert and follow the weld—graphic proof of 100% parent metal weld strength.

MISSILE TANKS *called for Pioneering, too!*

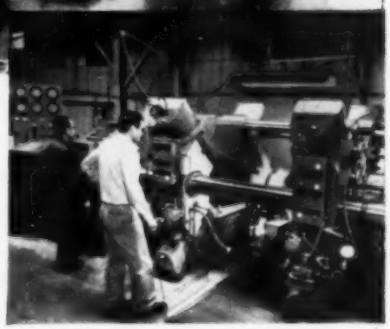
MENASCO UNIWELDS

PROVIDE FULL STRENGTH UTILIZATION IN HEAVY WALL PRESSURE VESSELS

Missile components, like the overall Missile System, have demanded that their designers and engineers pioneer with fresh thinking and new ideas in order to keep abreast of modern guided missile research and development. A case in point is MENASCO'S design and production of air tanks for the Nike missile featuring MENASCO'S now-famous *Uniweld* process, an exclusive method of pressure welding.

The twelve-inch diameter welds in the Nike tank fuse in two operations approximately 34 square inches of alloy steel. Because the *Uniweld* maintains parent metal strength, no increase in local wall thickness is needed and the tank becomes virtually a one-piece vessel.

Thus, MENASCO'S pioneering work in *Uniwelding* of missile tanks has opened entire new fields of pressure vessel applications where high strength welds make the difference.



One of MENASCO'S *Uniweld* machines in operation. This exclusive MENASCO process is gaining wide acceptance in the aircraft and missile fields.

Specialists in Aircraft Landing Gear

menasco manufacturing company

805 SOUTH SAN FERNANDO BOULEVARD, BURBANK, CALIFORNIA

THE WRAPS ARE OFF

The New 680 Aero Commander

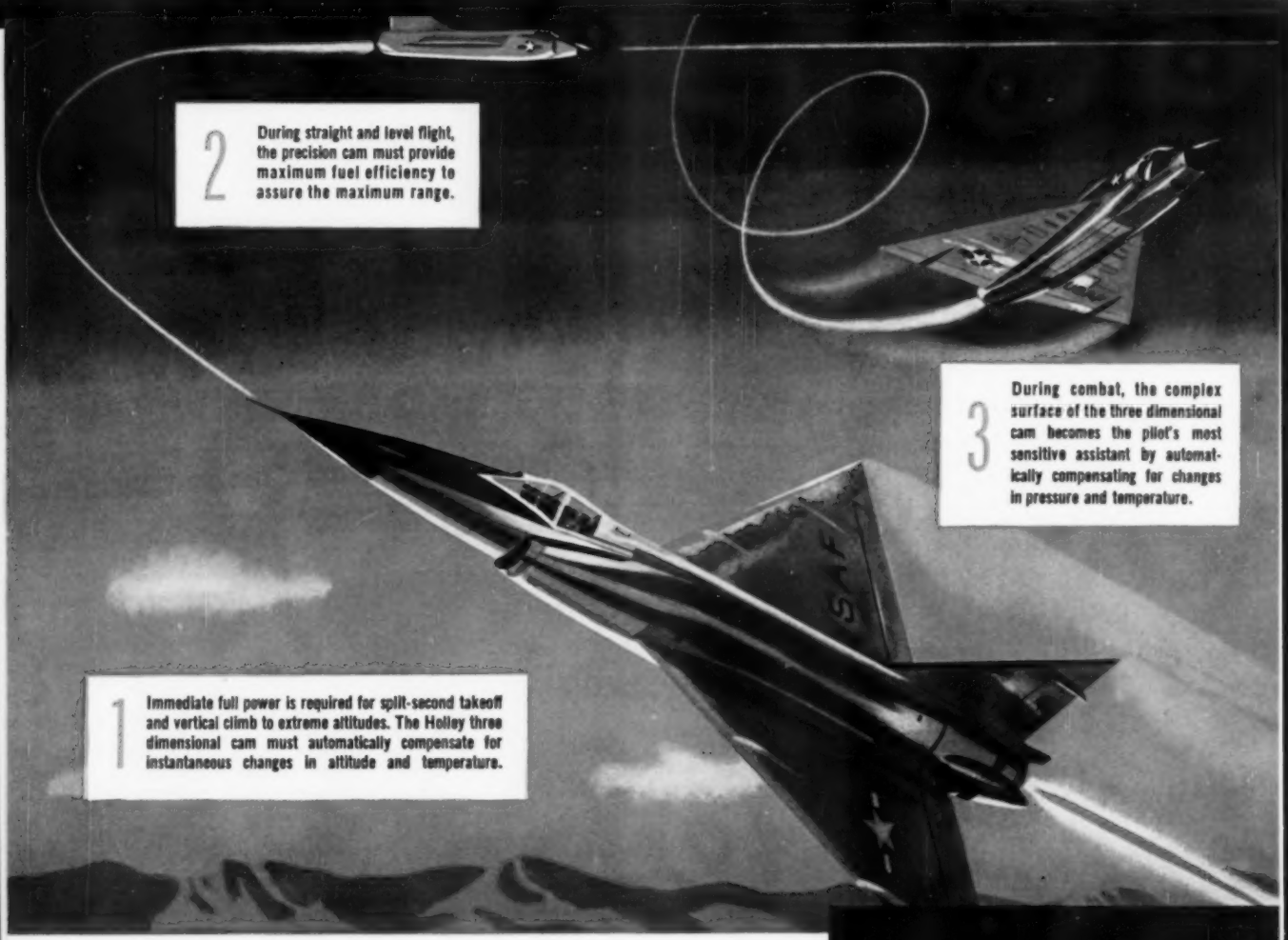
WITH LEAR ABUNDANTLY DESIGNED INTO IT

When the high-performance Model 680 "Super" Aero Commander was at the design stage, specific structural and space provisions were made for Lear equipment – complete Lear L-2 autopilot system with automatic altitude control and automatic approach coupler – Lear LVTR-36 VHF crystal-controlled 36-channel transceiver–Lear Model 2200 marker beacon receiver – Lear ADF-14C automatic direction finder – Lear LTRA-6 VHF transceiver system with omni – Lear broadband VHF antenna. All these units have been installed in company demonstrators, and Aero Design and Engineering Co. officially offers this complement of Lear equipment.

Take a tip from the builders of the great new 680 "Super"... specify Lear!

LC-30

LEAR LEARCAL DIVISION, 3171 S. BUNDY DR., SANTA MONICA, CALIFORNIA

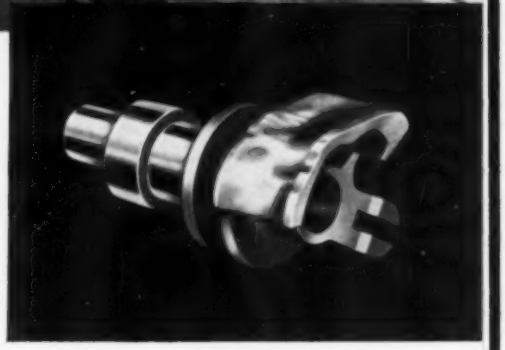

2 During straight and level flight, the precision cam must provide maximum fuel efficiency to assure the maximum range.
3 During combat, the complex surface of the three dimensional cam becomes the pilot's most sensitive assistant by automatically compensating for changes in pressure and temperature.
1 Immediate full power is required for split-second takeoff and vertical climb to extreme altitudes. The Holley three dimensional cam must automatically compensate for instantaneous changes in altitude and temperature.

How the Holley three dimensional cam functions as an automatic co-pilot

The job of the Holley Power Control for jet aircraft is to sensitively control engine power according to the pilot's requirements and, at the same time, make automatic adjustments for split-second variations in altitude, pressure and temperature. The "brain center" of advanced Holley controls is a three dimensional cam which is so contoured that it can adapt itself to all combinations of atmospheric temperature and pressure, from Thule to the Equator and from sea level to extreme altitudes.

In addition to the automatic compensations made for the pilot by the three dimensional cam, it interprets the pilot's request for changes in power. It's the most important link between cockpit and engine.

The three dimensional cam, like the power control itself, is designed, engineered and manufactured by Holley—one of the world's foremost power control manufacturers.



Typical "brain center" of a Holley aircraft engine control. Note the delicate machined surfaces. Each plays a vital role in mechanically regulating the engine under varying conditions.

HOLLEY Carburetor Co.

11955 E. Nine Mile Road • Van Dyke, Michigan

LEADER IN THE DESIGN, DEVELOPMENT, AND MANUFACTURE OF AVIATION FUEL METERING DEVICES

A-23

TWIN FEATURES FOR THE TWIN-BONANZA are weight saving and rigidity through use of magnesium sheet for the elevators, rudder and ailerons.

Private planes, too, made with MAGNESIUM

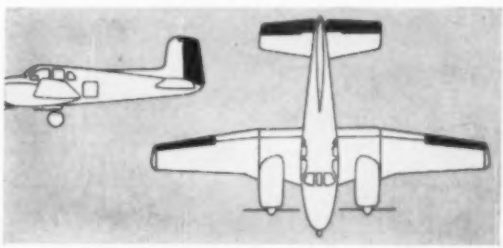
LUXURY TRANSPORTATION for six people is provided in the stylish Twin-Bonanza. Lightweight magnesium contributes significantly to a top speed of 214 mph—a range of 1650 miles.

Vital areas of the new Beechcraft Twin-Bonanza are made with magnesium for extra lightness . . . extra rigidity

Less weight and greater rigidity. Design simplicity and cost reduction. These are benefits of magnesium that Beech Aircraft Corporation has utilized for many years. They build an outstanding product using this lightest of all structural metals. You can do the same thing.

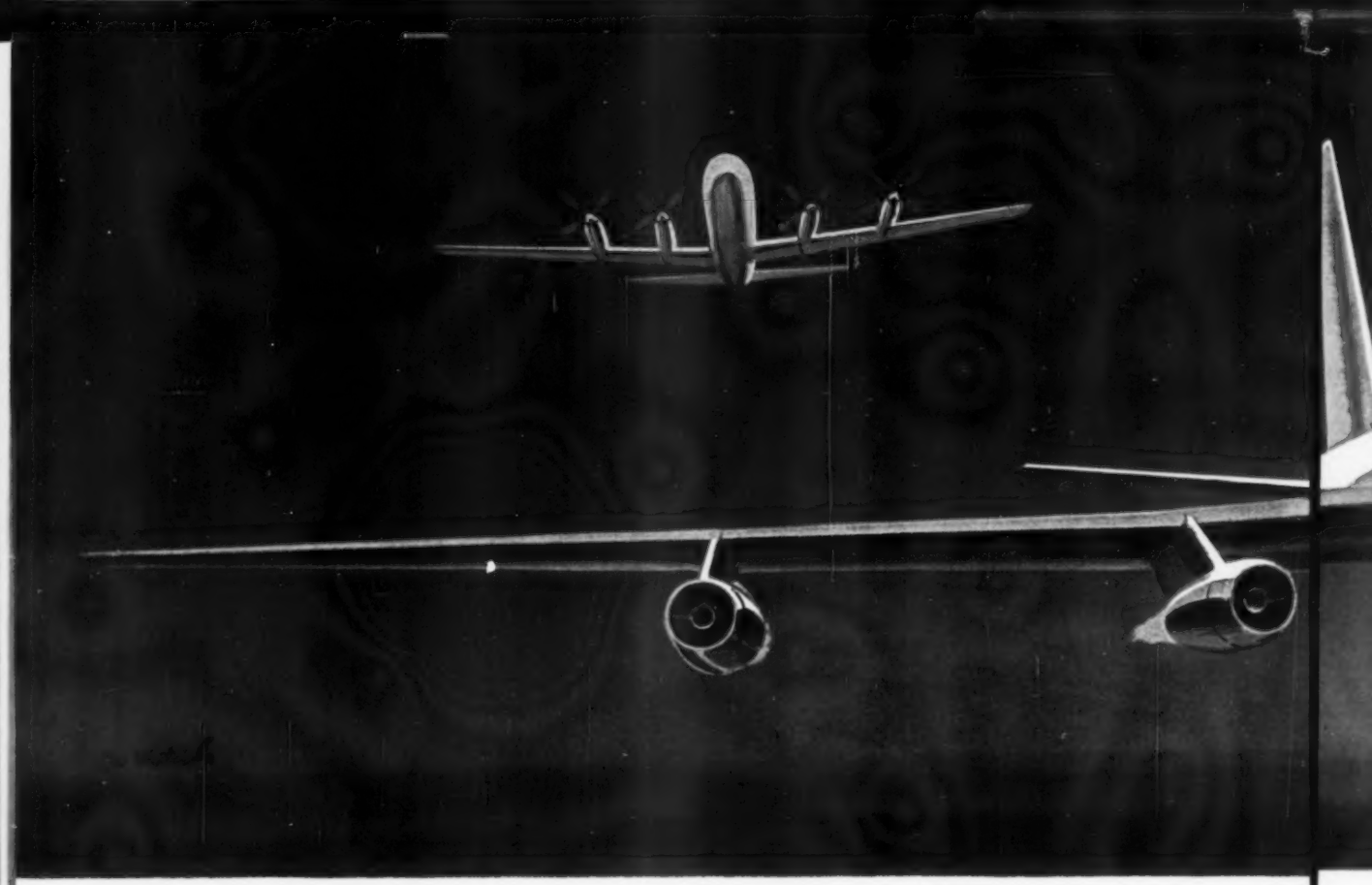
If lighter weight will improve your product, if extra strength will do it, or simplified design and fabrication—then the best choice of metal for you is magnesium!

You'll get prompt attention from your nearest Dow sales office, or THE DOW CHEMICAL COMPANY, Magnesium Sales Dept., MA 359G-2, MIDLAND, MICHIGAN.



PARTS MADE OF MAGNESIUM SHEET are indicated by dark areas in this diagram of the new Beechcraft Twin-Bonanza.

you can depend on DOW MAGNESIUM



ANNOUNCING NEW SPERRY F

P-442

FLIGHT CONTROL SYSTEM

SP-30 designed for new Jet and Turbo-prop Transports

Sperry's experience in designing and building flight control systems for multi-jet aircraft has enabled Sperry engineers to design the new SP-30 Flight Control System to meet the requirements of the airliner of the forthcoming jet age. This system is based on an entirely new concept of flight control.

In 1946 Sperry introduced its now-famous Model A-12 Gyropilot® to the airlines. Since that time, this system has been installed in hundreds of DC-3s, DC-4s, Convairs, Stratocruisers, DC-6Bs and DC-7s, and is in daily use by most of the major airlines.

Later models were designed for many military applications in high-speed jet and turbo-prop aircraft. By working in close cooperation with the military and the design groups of Boeing, Douglas and Lockheed, Sperry developed flight control systems for the B-47, B-52, A3D and the C-130. Thousands of these aircraft are being flown today by these flight control systems.

With this broad, unparalleled experience, Sperry engineers have now designed the SP-30 to meet the needs of tomorrow's jet and turbo-prop commercial airliners. For further information, write our Aeronautical Equipment Division.

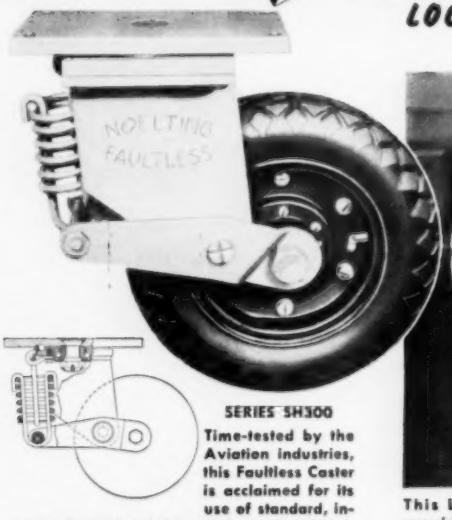
SPERRY GYROSCOPE COMPANY
Great Neck, New York

DIVISION OF SPERRY RAND CORPORATION

P-442

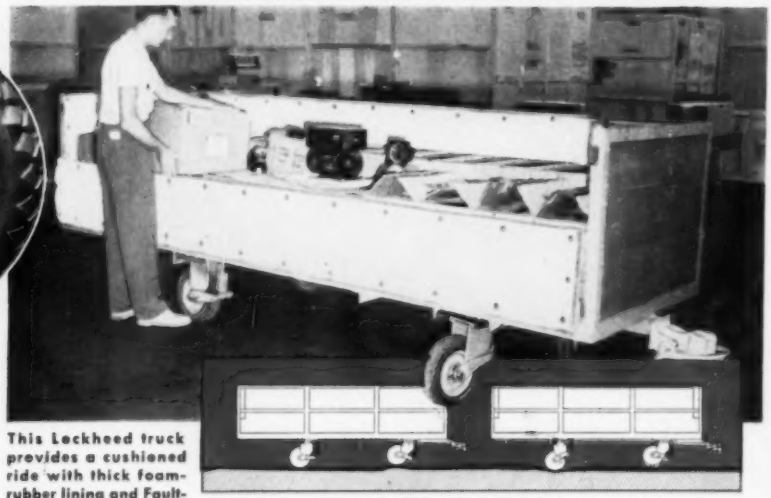
HOW Faultless AIRMASTER CASTERS ARE SERVING AVIATION

LOCKHEED AIRCRAFT CORP., MARIETTA, GEORGIA ... MOVES FRAGILE INSTRUMENTS SAFELY



SERIES SH300

Time-tested by the Aviation industries, this Faultless Caster is acclaimed for its use of standard, interchangeable wheels . . . absorption of high impact shocks through use of large, durable springs under constant compression . . . spring and draw bar assembly a separate, interchangeable member. Choice of spring tensions allows specialized use of this caster, according to loads carried and terrain encountered.

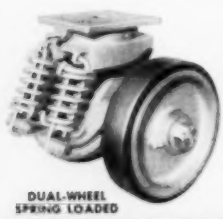


This Lockheed truck provides a cushioned ride with thick foam-rubber lining and Faultless Double Action Spring Casters.

The Faultless SH 332-12 x 3 Double Action Spring Caster has a unique construction that maintains a level load on trucks when moving over irregular floors. Wheels contact floor surface at all times—eliminate bounce—don't raise truck when mounting obstacles or drop when passing over depressions in the floor.

How Lockheed Aircraft Corporation, Marietta Division, materials handling engineers move the B-47's multitude of electronic devices provides the basic information of how your own materials handling problems may be solved. A truck was needed to move the airplanes' electronic equipment without damage. In order to facilitate their movement and carry the load safely through the production locations and inspection stations, the Transportation Department of Lockheed decided upon a foam-rubber lined truck mounted on Faultless Double Action Spring Cushion Casters equipped with pneumatic wheels. Faultless Casters were selected since they best fulfilled the requirements of providing a smooth, jolt-free, low cost ride for the electronic instruments. We can solve *your* caster problems, as we have for many in the industry. Simply call your local Faultless Caster Distributor listed in the yellow pages of your phone directory, or write us today.

Two of many AIRMASTER Casters produced for the Aviation Industry



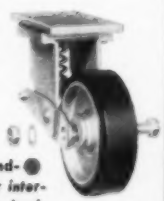
DUAL-WHEEL SPRING LOADED

Made in accordance with Military Specifications. Write for specification data.

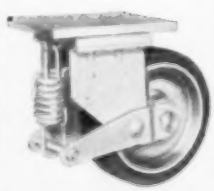
SPRING ACTION POSITION LOCK ON SWIVEL

3 FEATURES EXCLUSIVE WITH AIRMASTER CASTERS

● **Shock-Absorbing Spring Action *parallel to the center line of King Bolt* to balance the load and allow wheel to be in contact with floor at all times, regardless of rough floors or bumpy terrain.**



● **Caster wheels of standard design are *easily interchangeable with stock wheels* to minimize maintenance and "down" time.**



● **Spring Action Caster *continues to function as conventional Caster* in case overload exceeds maximum spring load rating. An important safety factor to load operators.**

FAULTLESS CASTER CORPORATION

EVANSVILLE 7, IND.

Offices in Atlanta, Baltimore, Boston, Buffalo, Chicago, Cleveland, Dallas, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New Orleans, New York, [illegible]

Beyond the Point-of-No-Return . . .
A New Meaning for Dependability

DOUGLAS C-124

Most Magnetic Amplifier Voltage Regulators now flying are Cline built.

Regardless of the plane or the mission, rugged dependability means everything beyond the point of no return.

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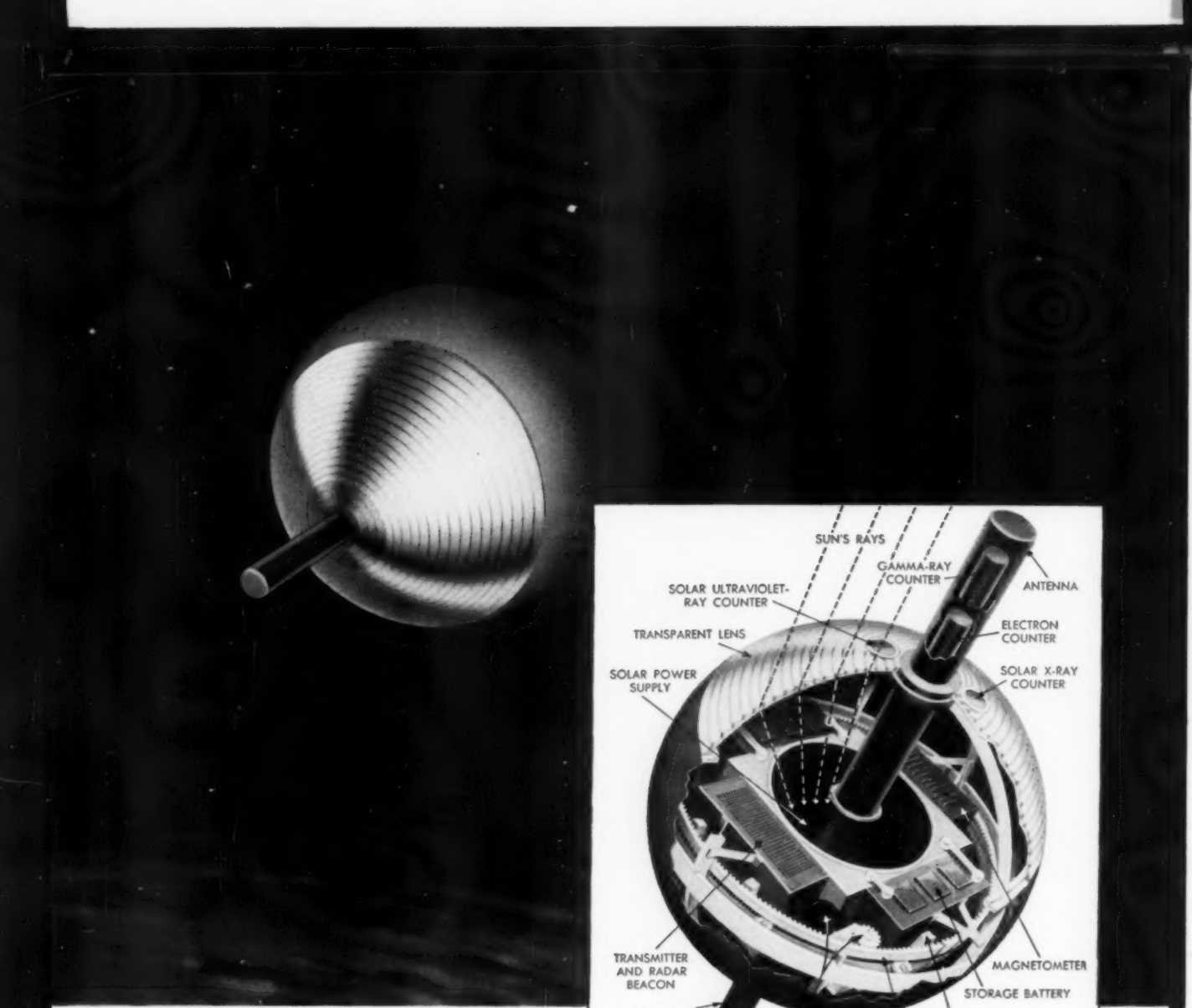

ILLUSTRATIONS COURTESY OF POPULAR SCIENCE MONTHLY

This "Bird" is the man-made satellite as visualized by an artist. Fenwal makes many things to make flight safer and surer; controls for many of the variables that need constant checking.

How would you control this satellite's temperature?

Scientists know man-made satellites will fly. But manufacturers must build them. Temperature-control is sure to be one of the vital factors in their successful 18,000 m.p.h. journey.

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At Fenwal you'd know you'd find the facilities you need . . . metals-characteristics analysis experts and equipment . . . a vibrations laboratory and personnel able to anticipate the topsy-turvy life thermo-control equipment will have aboard the satellite.

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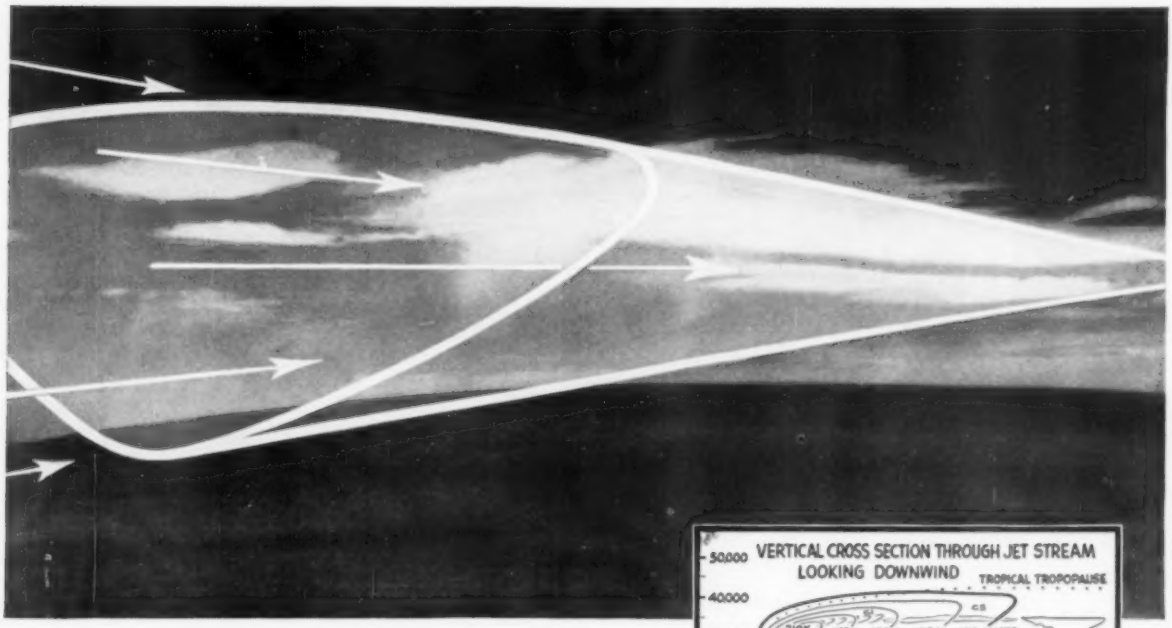
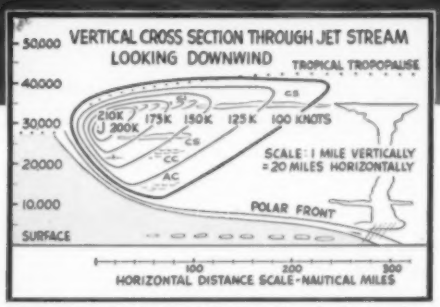
These weather items prepared in consultation with the United States Weather Bureau





Clear air turbulence is believed to be limited to left-hand edge and top of jet stream. Rapid changes in temperature (10°F. or more in 1° latitude) occur on colder left side.

JET AGE DEVELOPMENTS

JET FLIGHT — As jet flight becomes more commonplace, it's increasingly important to understand and recognize the problems and phenomena associated with high altitude, high-speed travel. Clear air turbulence, sudden wind and temperature changes, subsiding air are some of the meteorological features now being explored.

JET STREAM—A recently discovered current of high-speed winds moves from the West across the middle latitudes of both hemispheres. Maximum wind velocities of over 200 knots are reached at altitudes of 35,000 to 40,000 ft., varying as much as 15 knots per 1,000 ft. up to the core. Cross-sectional view at upper right best shows jet stream structure.

JET FUELS — To meet the critical demands of substratosphere flights, jet fuels must also act as cooling agent. New manufacturing procedures developed by Socony Mobil can produce jet fuels with improved thermal stability to meet these critical requirements.

First fueling of turboprop airliners to go into commercial service in U.S.A. is being handled by Socony Mobil. The customer is Trans-Canada Air Line's Viscount Fleet.

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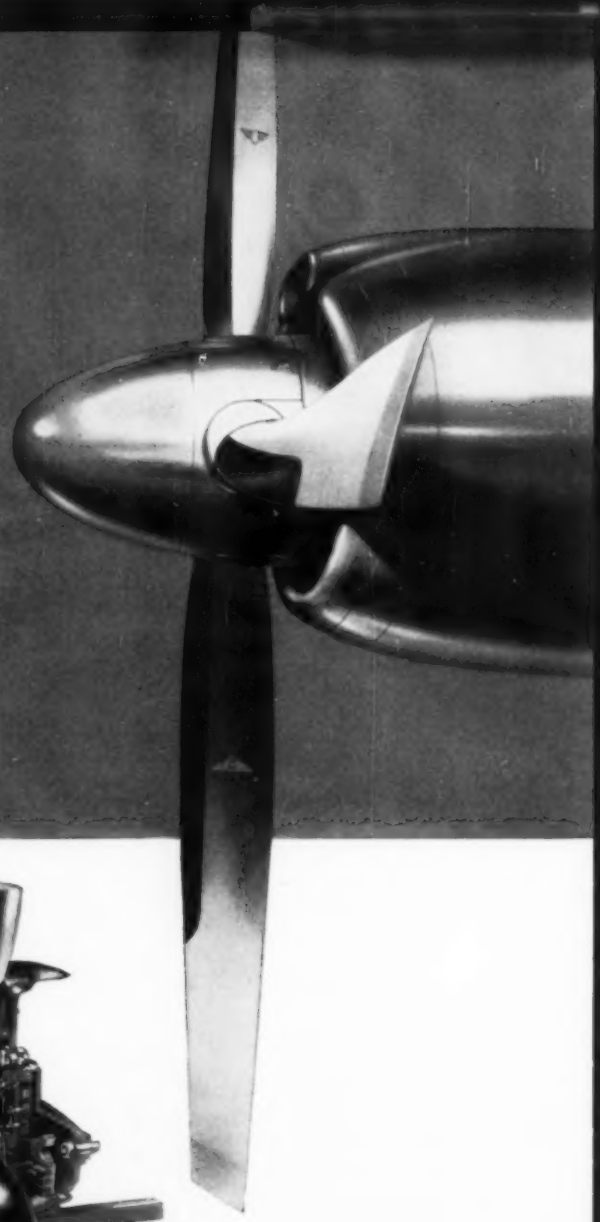

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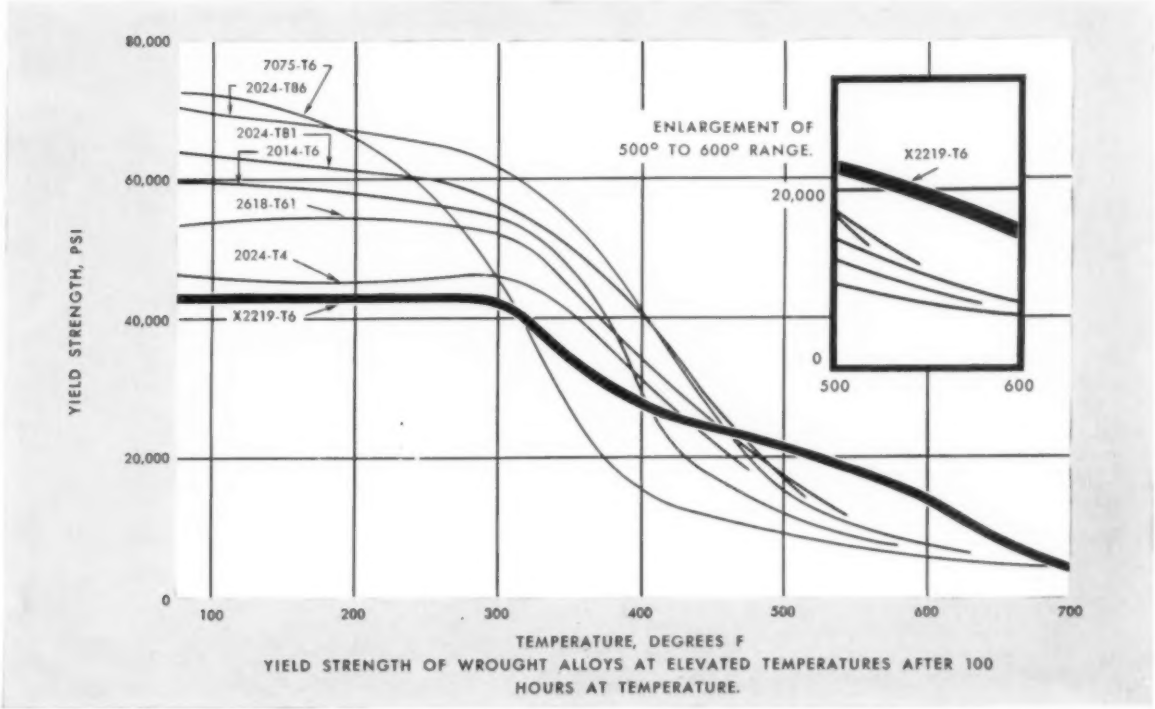

YIELD STRENGTH OF WROUGHT ALLOYS AT ELEVATED TEMPERATURES AFTER 100 HOURS AT TEMPERATURE.

Some structural airframe members now reach temperatures of 600° in piloted craft and even higher in missiles—the result of the aerodynamic heating effect of higher speeds and proximity to engines, de-icers, etc.

Alcoa is developing new alloys to serve at these higher temperatures. One of the most promising is X2219. We are now offering forgings of X2219 and also rolled and extruded shapes. It will also be available in sheet and plate form, if warranted by demand.

As the chart above demonstrates, X2219 far outshines conventional alloys in the 500° to 600° range. This chart shows tensile yield values after 100 hours. Tests made after 1,000 hours show the same superiority for X2219. Also, compressive yield strengths do not differ greatly from tensile values, especially at elevated temperatures.

Physical properties of X2219

The following minimum and typical properties are applicable to rolled and extruded shapes up to 4" thick, to separately forged test specimens and to die forgings up to 4" thick when the axis of the test specimen is substantially parallel to forging flow lines.

	Guaranteed minimum	Typical
Tensile Strength, psi	55,000	62,000
Yield Strength, psi	35,000	43,000
Elongation—% in 4D	6	16

We expect that X2219 will have an important place in airframe structural members and also in gas turbine and piston engine parts. With the world's largest light metal forging facilities, we are ready to help you utilize the advantages of this important new alloy.

When writing for additional information on Alcoa high-temperature alloys, give operating conditions which must be met. Aluminum Company of America, 1800-D Alcoa Building, Pittsburgh 19, Pa.

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APRIL 9, 1956

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VOL. 64, NO. 15

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COVER: Fairchild C-123, the USAF's new workhorse designed to give the Army GI greater mobility and free him from much of his traditional slogging, pulls off from a rough, unprepared landing strip. For details on USAF-Army plans for the assault transport, see page 28.

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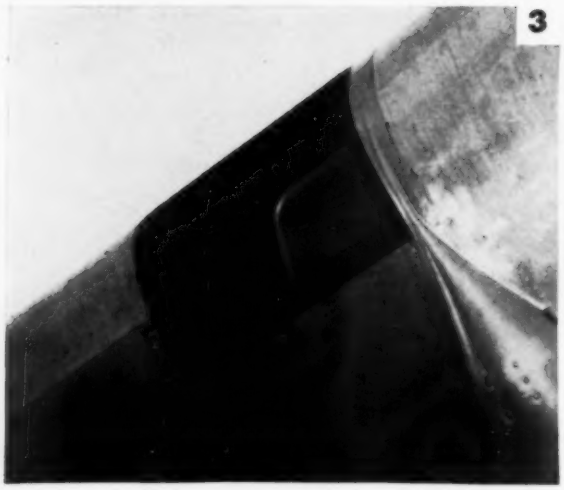

4 hot recipes that do away with icing

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2. *On reel oil coolers,* like these on the KB-50 (Hayes modification), it keeps ice from choking off vital air supply.
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EDITORIAL

Airpower Budget Issues Are Clear

The Fiscal 1957 airpower budget proposed to Congress falls short of meeting the real requirements of the 137 combat wing Air Force program by about $3.5 billion. The $16.5 billion USAF budget presented to Congress for Fiscal 1957 was achieved by Defense Department imposition of a wide variety of one-shot economies that do not represent any legitimate savings but simply postpone the real cost of the 137 wing program until Fiscal 1958.

This is clear from the recently disclosed testimony before the House Appropriations Committee by USAF Chief of Staff Gen. Nathan F. Twining, USAF Secretary Donald A. Quarles, USAF Undersecretary James Douglas, former USAF Assistant Secretary for Research and Development Trevor Gardner and Assistant USAF Secretary for Financial Management Lyle Garlock.

Truman-Johnson Cutback

Under skillful questioning by Congressmen, Gen. Twining repeatedly stated that USAF could live with the Fiscal 1957 budget only if it had assurance of an increase on the order of $3.5 billion for Fiscal 1958. Since a national election intervenes between Fiscal 1957 and Fiscal 1958 it is obvious that neither the Congress nor the President can give any such assurance.

This leaves the Fiscal 1957 airpower budget as the same kind of calculated risk cutback that led President Truman and his Defense Secretary Louis Johnson to reduce the size and effectiveness of the Air Force less than a year before the Korean war. The $800 million these Democrats sought to save in 1949 cost the American taxpayers as yet uncounted billions and a river of American blood.

With this background, the following excerpts from USAF testimony to Congress early this year make the issues clear:

USAF was cut $1 billion in aircraft procurement (400 planes) by simply ordering only 10 month's production (1,900 planes) instead of a full year (2,300 planes). This was explained as an artificial device accomplished simply by postponing the ordering of aircraft, which also means postponing delivery dates to USAF. Undersecretary Douglas admitted this would simply boost the Fiscal 1958 procurement bill higher to make up for cuts imposed this year.

Combat Units Weakened

Gen. Twining testified that Tactical Air Command is able to operate only 18 of the 25 North American F-100s delivered to each squadron because of the lack of maintenance personnel and funds. He said USAF was getting planes faster than it could put them into operation due to fund limitations in the maintenance and operations budget.

He also testified that many USAF combat units were far from required levels of combat readiness because of insufficient funds for flying and training activities. He said every one of his major field commanders was worried about the financial restrictions on training operations that were reducing the efficiency level of their wings.

In response to a "put up or shut up" question by Rep. Daniel Flood (D.-Pa.) Gen. Twining admitted that USAF badly needed more Fiscal 1957 funds for research and development, maintenance and operations and base construction. He indicated the only reason USAF was not pushing for more procurement funds was that it could not effectively operate the new planes it was getting under the current maintenance and operations budget.

Secretary Quarles testified that: "I believe our count today is that 30% of our combat aircraft that one must expect as of any one instant not to be ready to take-off on a combat mission."

It was also made clear that USAF's research and development budget is pre-determined by the Defense Department, which set an overall fund total and then allocated USAF a portion.

The details of these one-shot artificial cuts in the Fiscal 1957 airpower budget were revealed along with testimony that showed this country is facing the most serious challenge in its military history—the rise of Russian airpower.

Vulnerability Increased

Secretary Quarles testified that despite the improvements in our radar warning systems and the Century series interceptors expected during the next two years, "A net evaluation would say that we lose ground rather than gain ground as far as the vulnerability of our continent is concerned when the Russians have converted to a heavy jet bomber (the Bison)." Gen. Twining testified that the Russians not only have more Bisons now than USAF has B-52s, but will continue to maintain and increase this advantage if both countries continue their currently planned production rates on this vital type of aircraft.

Trevor Gardner testified that the principle reason for his resignation was: "I could not in good conscience participate in a program which had a reasonable chance, in my opinion, of losing the technological race with the Russians."

Gen. Twining warned: "While Congress heeds the clear evidence of growing Communist airpower there appear to be some who ignore it or who wish this danger would just go away."

Gardner analyzed the present airpower budget controversy as follows: "The rate of technological progress in this country and in Russia is proceeding at a pace faster than the decision-making process of the (U.S.) government can react to. I think that you will find when the decision-making processes finally do catch up with the technological progress that has me alarmed, that they will come to this particular budget level ($20 billion) that I am recommending and the only price we will have paid will be a delay of one or two priceless years."

We think so too.

—Robert Hotz

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In the Front Office

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Additional TWA promotions (technical) in Kansas City: **R. W. Rummel,** vice president-engineering; **R. M. Dunn,** vice-president-overhaul and maintenance; **F. G. Betts,** vice president-purchasing. Also, **J. Woodrow Thomas** of Washington, director of civic affairs, elected assistant vice president.

Sir Miles Thomas, who resigned as chairman, British Overseas Airways Corporation (AW Mar. 26, p. 93) succeeds **E. A. O'Neal, Jr.,** as chairman of Britain's Monsanto Chemicals Limited.

A. W. Laird, vice president-government relations, New York Air Brake Co., N. Y. Also, **H. R. Doughty, Jr.,** general sales manager, Stratopower Section, Watertown, N. Y.

Major Gen. James E. Briggs to succeed **Lt. Gen. Hubert R. Harmon** as Superintendent of U. S. Air Force Academy on Aug. 1, 1956.

Honors and Elections

Dr. George P. Cressman, USAF Air Weather Service, was awarded the Decoration for Exceptional Civilian Service, the highest Air Force civilian honor, for outstanding accomplishments in weather analysis and forecasting.

Paul Rosenberg, president of Paul Rosenberg Associates, received the Talbert Abrams Award of the American Society of Photogrammetry.

Changes

Elden H. Olson, engineering director, Aeronautical Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. Also, **Clyde Parton,** manager, Ordnance Division.

William F. Whitesides, engineering manager, and **C. Harry Smith,** chief engineer, Flight Refueling, Inc., Baltimore, Md.

Robert R. Lent, West Coast coordinator, Electronics and Instrumentation Division, Baldwin-Lima-Hamilton Corp., Los Angeles, Calif.

Walter Michel, general manager, Utica Division, Bendix Aviation Corp., Utica, N. Y.

Max Bowen, general manager, Vertol Aircraft Company (Canada) Ltd., Arnprior, Ont. Also, **Alfred P. Tolley,** to head Dayton office, Vertol Aircraft Co., Morton, Pa.

INDUSTRY OBSERVER

► Private industry is building an underground missile manufacturing plant near Huntsville, Ala., Army Ordnance also plans to build a large new solid propellant rocket plant in the Huntsville area.

► Boeing is now offering airlines a scaled down version of its Model 707 Stratoliner aimed at competing with the Convair Skylark (see p. 99) in the medium-haul field. Boeing's transcontinental and transatlantic versions of the Stratoliner range up to 300,000 lb. gross weight but the new scaled down version is in the 180,000 lb. gross weight class, close to the maximum planned gross of the Skylark.

► Western Electric is receiving a fixed fee of $11,970,000 for its USAF Distant Early Warning (DEW Line) project. This fee amounts to about 4.2% on an estimated contract cost of $272,500,000.

► Douglas A2D turboprop attack bomber program cost the Navy $14.9 million for six airframes plus $39.5 million contract termination costs on an original program calling for 341 aircraft. Navy blamed difficulty with the T40-A-6 turboprop for cancelling the program. Allison is presently flying two A2Ds equipped with the T40-A-6 engine as research aircraft at Indianapolis.

► Official Navy statements to the House Appropriations Committee were that the chief of the Navy's Bureau of Aeronautics advised Westinghouse Aircraft-Turbine Division that the J40-22 and the J40-22A engines to be used in the McDonnell F3H-1 were "unreliable" and that some of the 107 of these engines delivered to the Navy will be subject to re-pricing. Navy says Westinghouse does not concur in its evaluation of these engines.

► Allison Division of General Motors is working on a $13 million program to improve high altitude fuel consumption of its T-40-A-10 turboprop in the Convair R3Y flying boat. Convair also has a $12 million airframe improvement program on this plane. Navy says deficiency in high altitude engine performance is the main problem left on the R3Y. R3Y program has cost the Navy $231 million dollars for 11 aircraft.

► Area rule fuselage design (AW Sept. 12, 1955, p. 12) has been incorporated into F-105 supersonic fighters now being manufactured by Republic Aviation Corp. The new design was used on the third plane off the production line, which soon will be delivered to USAF.

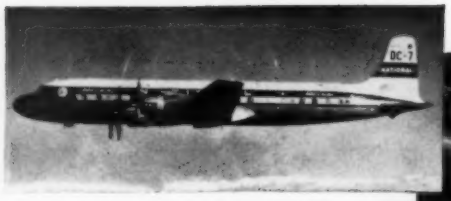
► First flight of the Douglas XF5D-1 prototype is scheduled for late this month from Edwards AFB, Calif. The aircraft is somewhat similar in configuration to the F4D but is larger and has higher performance.

► First prototype of the Sncase SE 210 Caravelle jet transport will be delivered to Air France this month for route trials. As part of the trials Air France will haul freight in the twin-jet airliner powered by 10,500 lb. thrust Rolls-Royce Avon RA 29 engines. April delivery is somewhat earlier than expected (AW Jan. 23, p. 103) and may indicate that the Caravelle will be in scheduled service next year instead of early 1958 as previously announced. Air France has 12 Caravelles on order and 12 more on option.

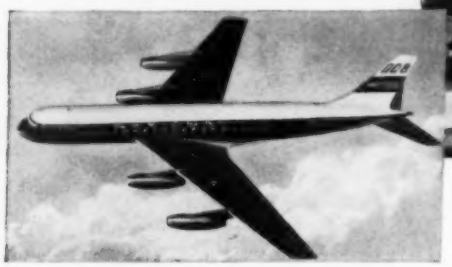
► McDonnell has modified an F-101A Voodoo to flight test certain F-101B long-range interceptor characteristics.

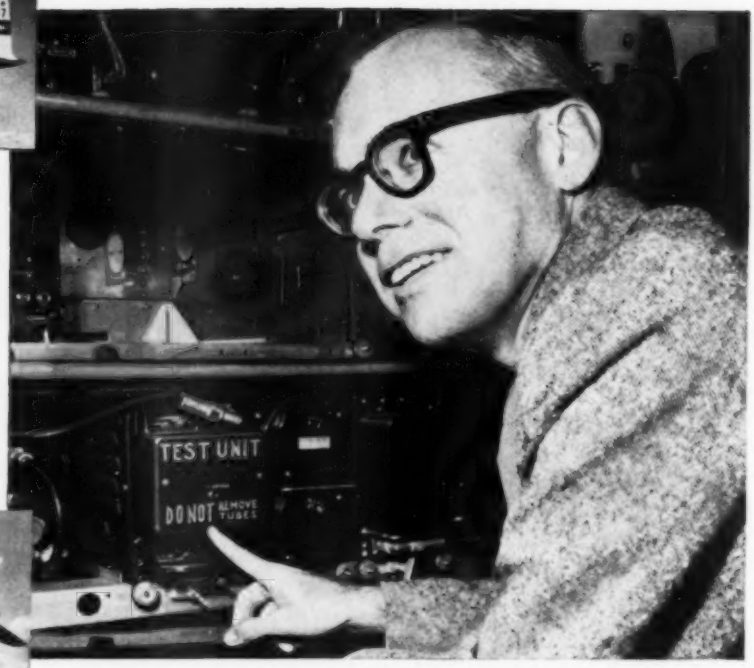
► Vertol H-21C, in Army flight tests at Ft. Rucker, Ala., has hovered at gross weight of slightly less than 17,000 lb., useful load of more than 8,200 lb.

► A new variety of gas turbine, the differential gas turbine, is in the embryonic design stage. It may be used in certain helicopter and turboprop applications where fuel economy at partial load is desired, according to its designer, D. W. Hutchinson, Mamaroneck, N. Y. Special feature is compressor and turbine shaft have been interconnected by differential gearing to drive shaft.



Progress is a keynote with National Airlines. Their four-engine DC-7's, shown above, offer the latest in speedy, luxurious air travel. National's aircraft of tomorrow—the jet-propelled DC-8 below—has an important place in the company's future plans. This newest advancement in aviation is expected to be in service by 1958.





W. E. Morris, Manager of Communications, National Airlines, Inc.

Says

"G-E 5-Star Tubes give National noise-free communications...and they cut our costs!"

"One reason we install G-E 5-Star high-reliability tubes is the fact they have very low microphonics. They give crisp, clear radio reception, and messages are easily understood the first time. This virtually does away with time-wasting repeated transmission.

"Also, we save in two ways with 5-Star Tubes. First, we obtain more hours of tube service, which cuts our replacement costs.

"Second, 5-Star dependability means we need to carry less reserve electronic equipment at airports. You see, there isn't enough time during normal short layovers to service flight equipment that has failed . . . new units must be installed complete. Trustworthy tubes and equipment help us keep down inventories.

"Finally, we gain because the reliability of G-E 5-Star Tubes in airborne navigation and other equipment helps National Airlines to meet schedules. This attracts and holds passengers for any airline!"

* * *

5-Star Tube benefits, proved by National, are available to you. Your local G-E tube distributor stocks these special high-reliability receiving types. Phone him today! *Tube Department, General Electric Company, Schenectady 5, New York.*

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361-1E10

Washington Roundup

Snark Flight

Last week's disclosure that the Northrop Snark has flown 2,000 miles may have been made in response to some digs from Congress. Said one informed Washington observer:

"They proved a jet engine can fly 2,000 miles. What else?"

Possible explanation for the disclosure is found in the House budget hearings, where Rep. Daniel J. Flood (D.-Pa.) questioned Reuben B. Robertson, Deputy Secretary of Defense. Speaking of the ballistic missile, Robertson said: "We are in a position to fire (long) distances in the immediate future." Later, Flood suggested that he do so, the next Saturday morning from the Pentagon plaza. Robertson immediately made it clear that he meant to speak of the air-breathing missile not the ballistic missile. Flood came back with his challenge again: go out and do it by the end of the month.

Now it has been done by the air-breathing, jet engine-powered Snark, a weapon that was designed almost 10 years ago.

Some USAF planners are arguing that Snark should not go into full production except possibly as a stop-gap weapon.

The Northrop missile is a pilotless bomber, subsonic but relatively cheap. Range is supposed to be 5,000 mi. Unmentioned in most of last week's publicity was the fact that USAF doesn't have a 2,000-mi. test range. Instrumentation now is being provided for 1,200 miles out of Cocoa, Fla., indicating there has been no need for a longer one (AW Mar. 12, p. 100).

'Crash' Train Technicians?

The Congressional Atomic Energy Subcommittee on research and development focuses on the shortage of scientists and engineers in the U. S. with a comprehensive report detailing the training program of the various nations of the world. The subcommittee's chairman, Rep. Melvin Price (D.-Ill.), observed that it shows "the enormous effort by the Russians in the training of engineers and scientists and the unhappy effects of our own careless lack of effort in the area."

"Many warnings have been issued, many speeches have been made . . .," Rep. Price said. "I suggest that the time has come for strenuous measures, for action by the government, by business corporations, and universities, for what might be called a 'crash program' to increase swiftly and steadily the number of adequately-trained American scientists and engineers."

Congressional Actions Due

Early Congressional action can be expected on these matters:

• **Nomination of James Durfee** to be a member of Civil Aeronautics Board. Senate Commerce Committee has set a public hearing for Apr. 11 on this nomination, to be followed by an executive session to consider confirmation action. (Meanwhile, action on two other nominations—G. Joseph Minetti to the CAB and Charles J. Lowen to be Civil Aeronautics Administrator—depends on Sen. Mike Monroney [D.-Okla.], chairman of the Aviation Subcommittee.) Sen. Warren Magnuson (D.-Wash.), full committee chairman, did not refer the Durfee nomination to the subcommittee.

• **Elimination of the 10%** transportation tax on travel to Canada, Alaska, Hawaii, the Caribbean, and Central America. Legislation to accomplish this has been passed by both House and Senate. The only point at issue is a provision in the Senate version that for the tax exemption, travel to Canada and Mexico must be from points at least 225 miles inside the U. S. The House is expected to accept this. All other foreign travel already is exempt.

• **Penalties for sabotage** of aircraft. Legislation authorizing the death penalty or life imprisonment for sabotage to commercial carrier aircraft resulting in a death has passed the Senate and been approved by the House Commerce Committee. There may be some opposition on the House floor—House Judiciary Committee proposes that the coverage of the penalty should be extended to general service aircraft.

Competitor for F-27

Civil Aeronautics Administration would be authorized $25 million to finance up to one half the cost of development of prototype aircraft for local service operations, under legislation introduced by Rep. Carl Hinshaw (R.-Calif.).

The bill is pending before the House Commerce Committee, of which Hinshaw is a member.

CAA financing would be limited to $12.5 million, or 50% of the total cost, whichever is lower, on any one prototype project. The measure anticipates a $50 million development program for a local service plane to compete with the Dutch Fokker F-27, which has been licensed for production in this country by Fairchild Engine and Airplane Co.

More Baggage?

Rep. Carl Hinshaw (R.-Calif.) has opened a drive in Congress to get the 40 lb. limitation on domestic baggage raised to the 66 lbs. allowed for international air travel.

Air Transport Assn. estimates this would cost the scheduled carriers—trunks and feeders—about $20 million annually in excess baggage fees.

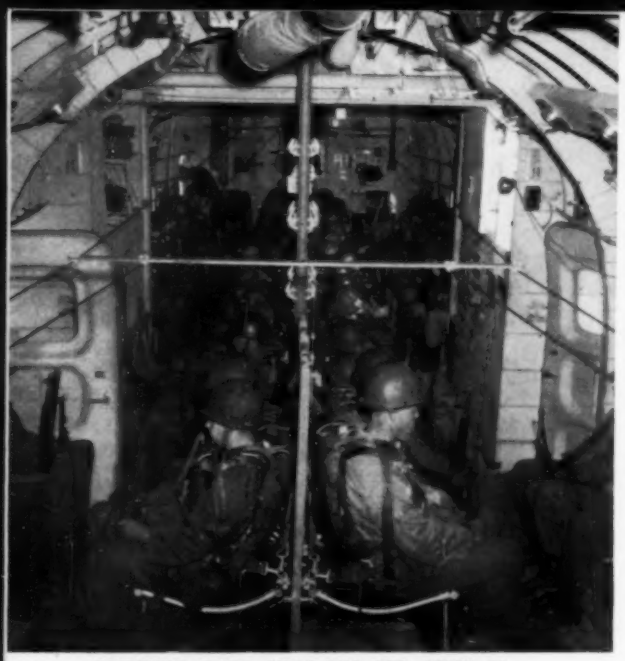
In a floor speech, Hinshaw objected that the 40 lb. ceiling was set in the era of much smaller aircraft, when weight was a major concern, and that this consideration now is outdated.

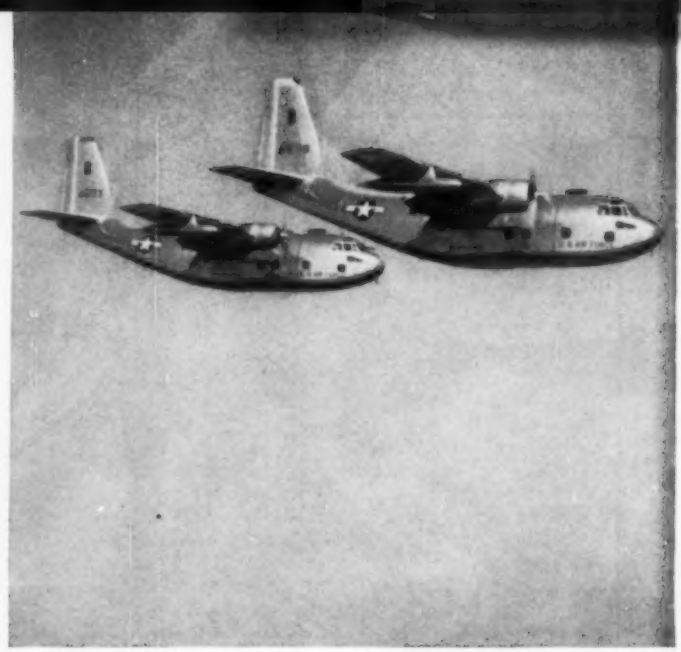
"How silly can we be?" he asked. "A Cuban can travel all over the U. S., if he is ticketed for it (from Havana), carrying 66 lbs. and the only difference between him and the American is that he flew over the 90 miles of the Gulf."

Airpower Investigation

The Armed Services Subcommittee headed by Sen. Stuart Symington (D.-Mo.) plans to begin its investigation of the airpower program with hearings, probably late this week, to develop facets of "the broad picture"—such as the adequacy of the 137-wing program. In its evaluation of airlift and missiles, the subcommittee is expected to cover Army and Navy programs, as well as that of the Air Force.

—Washington staff





FAIRCHILD C-123: USAF BUS FOR ARMY GI.

USAF Ready to Carry 'Walking Army'

By Claude Witze

Ardmore AFB, Okla.—USAF's 309th Troop Carrier Group Assault (Fixed Wing) will leave this base for Dreux, France, later this month, ready to put the walking Army into the air. The group is part of the 463rd Troop Carrier Wing commanded by Brig. Gen. Cecil H. Childre.

The 309th's commanding officer, Col. William C. Bentley, is emphatic that he is not running an ordinary airborne operation.

He says his new Fairchild C-123 assault transports are "built and operated for the dogface, not for flight personnel and paratroops.

"We have developed a new method of moving the GI," Col. Bentley told AVIATION WEEK, "and it is one that we can use with any soldier capable of sitting in a bus. Our mission is to land 'em on the assault field, ready to fight. And they don't need any special training before they come aboard."

The 309th is young, lusty and pioneering. In a little more than 10,000 hours of flying it has completed an accelerated service test on the C-123, proved the group's capabilities and worked out Standard Operating Procedures (SOP).

USAF CREWMEN and Army personnel join in unloading compressor onto rough dirt strip.

C-123's Capabilities

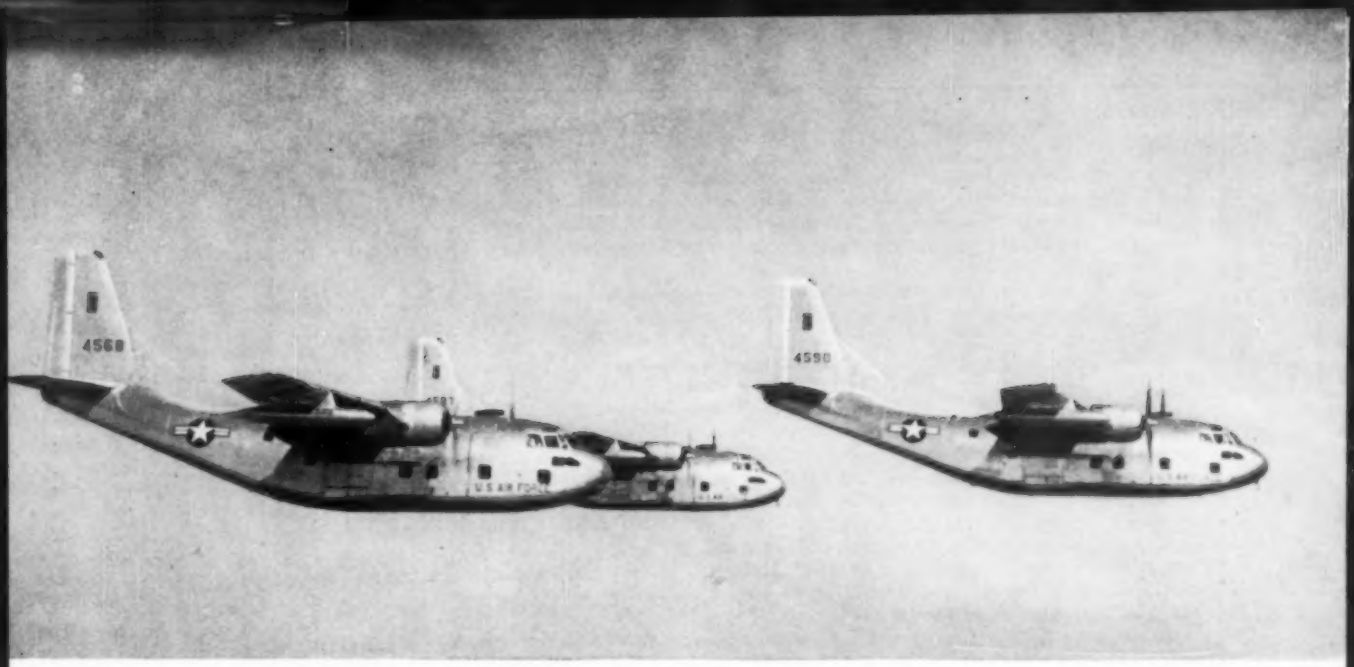
Major difference between the fixed wing assault transport and other aircraft is that the C-123 is ruggedly built to operate from unprepared landing strips with minimum takeoff and landing space requirements.

It is difficult to escape the conclusion that the C-123—pending perfection of genuine STOL aircraft with aerodynamic and propulsion improvements—is moving in as the Army's air truck. In this sense, the C-123 is headed for the role that the transport helicopter was going to fill before its capabilities were deflated by experience with maintenance problems.

For airlift into an assault landing area, rotary wings are ideal but expensive.

The C-123 is proving that it can perform the mission at a reasonable cost, utilizing cockpit and maintenance experience that is in USAF's backlog. And the equipment is not complicated or delicate.

Consider the fact that the C-123 is a new piece of hardware applied to a new concept of fixed wing transport, and what the 309th has done since it got its first delivery. Col. Bentley's



With C-123

group was activated at this base last July 8 and five days later it went to work shaking down the first two planes.

Removing the Bugs

They called it Operation Shakedown. In less than two months they did a normal year's work, finished up four and a half days ahead of the colonel's rugged schedule. His goal was to fly the first two C-123's nine hours each day until the first one had 500 hours and the second 300.

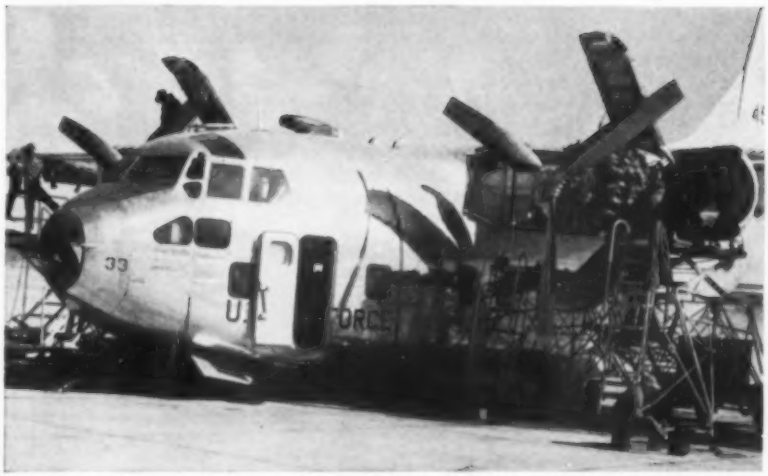
The idea was to uncover all the bugs at once, make the 309th operational in the shortest length of time and eliminate conventional operational testing. The job was finished on Sept. 1. When the 309th goes overseas this month, it will have corrected the C-123's few deficiencies, it will have its supply requirement tables, trained pilots and maintenance crews. The SOP's are complete.

In the aircraft itself, USAF has been fortunate.

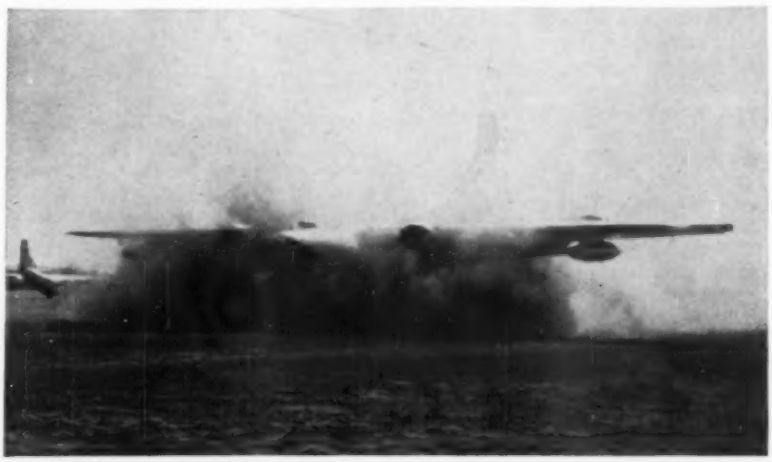
The plane has a tested power plant, the Pratt & Whitney R-2800-99W, and Hamilton Standard propellers. The design features simplicity, ease of maintenance.

There are, for example, no engine nacelles and no internal fuel tanks. The engine is bolted directly to the front spar and leading edge of the wing. The cowlings cannot be detached, dropped on the ground, blown away by the wind.

They stay on the engine, open up like an orange peel that has been slit into four sections. Fuel is carried in



'ORANGE-PEEL' cowlings on C-123 permit easy access to Pratt & Whitney R-2800 engines.



C-123 ASSAULT TRANSPORT lands in shower of dust as it hits unprepared strip.

Assault Aircraft Glossary

Assault aircraft have brought a new language into USAF operations. The jargon familiar to fighter, bomber, observation, transport and even paradrop groups is insufficient to describe concepts being practiced with the C-123. Here are some definitions, part of the Standard Operating Procedures for Troop Carrier Assault Operations:

- **Assault Aircraft.** Aircraft capable of sustained assault operations, characterized by rugged construction, short takeoff and landing roll and ease of loading and unloading.
- **Assault Approach.** A radically steep wheels-and-flaps-down final approach normally initiated suddenly with a steep pitch down and fully retarded throttle after passing the Assault Point made in such a manner as to minimize the effects of ground fire around the perimeter of the Landing Zone.
- **Assault Dispersion.** Dispersion effected on the ground or in the air for the purpose of reducing the effectiveness of hostile fire and reducing the size of the target offered by aircraft, personnel and supplies.
- **Assault Landing Area (ALA).** A pre-selected area within the Landing Zone, usually open terrain, designated as the operating area for landing and unloading assault type aircraft.
- **Assault Point.** The final timing point at the landing zone where aircraft pitch down on final approach into the assault landing.
- **Assault Takeoff.** The type of takeoff in which maximum permissible power is utilized and the aircraft, once airborne, climbs at as rapid a rate as practicable to minimize the effects of ground fire.
- **Corridor Flight Dispatcher.** Usually an assistant to the unit operations officer who, in continuous corridor type operations, clears, monitors and records the exact time of landings and takeoffs of all unit aircraft engaged in the mission to insure proper separation of flights.
- **Initial Point.** A prominent geographical location used as a reference and turning point for spacing and timing aircraft into the Assault Point.
- **Scat Landing.** The type landing made by aircraft landing in close trail, when the first and all succeeding aircraft touch down at the same point, continue the roll and turn off the landing area in a predetermined direction, made in such a manner as to clear the runway as soon as practicable for succeeding aircraft.

tanks aft of the engines, fastened to the wing by bomb shackles. They can be jettisoned in an emergency.

The C-123 lacks all the black boxes that require highly skilled maintenance crews and have been complicating USAF's effort to keep modern fighters and bombers up to combat standards. It lacks other things as well—it is about as plush as a freight car.

The assault transport was designed to operate out of postage-stamp fields and short-haul a large number of men and their equipment into combat areas under combat conditions. It got its start in life as a glider, designed by Michael Stroukoff. Fairchild later obtained the design, with power units added, from Chase Aircraft.

Operation Shakedown was intended to uncover bugs and Col. Bentley was successful in finding a few. The nose-wheel gear had to be redesigned for complete reliability and to ease handling on the ground.

Anti-icing equipment did not function properly in the early aircraft. Cabin heat was insufficient in frigid weather.

There has been some discussion of adding insulation to help in this problem and to reduce cabin noise.

Other flaws were minor. The 309th has never had an accident and never changed an engine. In more than 3,000 rough field landings there were only seven tire failures.

'Shakedown' Statistics

Here are some statistics from Operation Shakedown:

On maintenance for two aircraft flying more than nine hours a day for a total of more than 750 hours:

System	Man Hours
Aircraft general	2,006
Engine	920
Propeller	259
Electrical	369
Instrument	314
Hydraulic	386
Communications	459
	4,713

Indirect man hours: 5,695
Total squadron man hours: 10,408
Man hours per aircraft hour flown: 13.8

Consumption rates established for key supply items:

- **Nose wheel tire:** one per 73 flying hours.
- **Main wheel tire:** one per 66 flying hours.
- **Gasoline:** 183 gallons per hour.
- **Oil:** 7.8 quarts per hour.
- **Spark plugs:** one per 10 hours.

First realistic workout for the 309th was staged in November and December as part of Exercise Sagebrush, joint USAF-Army maneuver held in Louisiana.

Col. Bentley's report from Sagebrush concludes that the C-123 is the ideal plane for its mission.

Workout at Sagebrush

"We have successfully operated it from fields which no other medium transport aircraft, including the C-47, could utilize," the colonel said.

He did have some cogent suggestions for the Army. He pointed out, for example, that the center of gravity was not painted on any vehicle or piece of equipment the 309th was asked to carry. In addition, his crew needs to know the gross weight to help in proper loading of the C-123.

In one case a diesel powered road roller was brought out marked for a gross weight of ⅜ tons. Assuming this meant the vehicle weighed five tons empty and eight tons with the rollers full of water, and assured they were empty, the 309th tried in vain to load it. It was discovered that the rollers were carrying more than two tons of diesel oil.

Other Army equipment, such as jeeps and trucks, did not have clearly indicated the stress points where tiedown chains could be fastened.

Landing Areas Are Key

In his SOP, Col. Bentley says that in all operations the assault formations and landing patterns will be governed by the size, shape and number of landing areas available. Terrain conditions, parking facilities and the tactical situation also are factors.

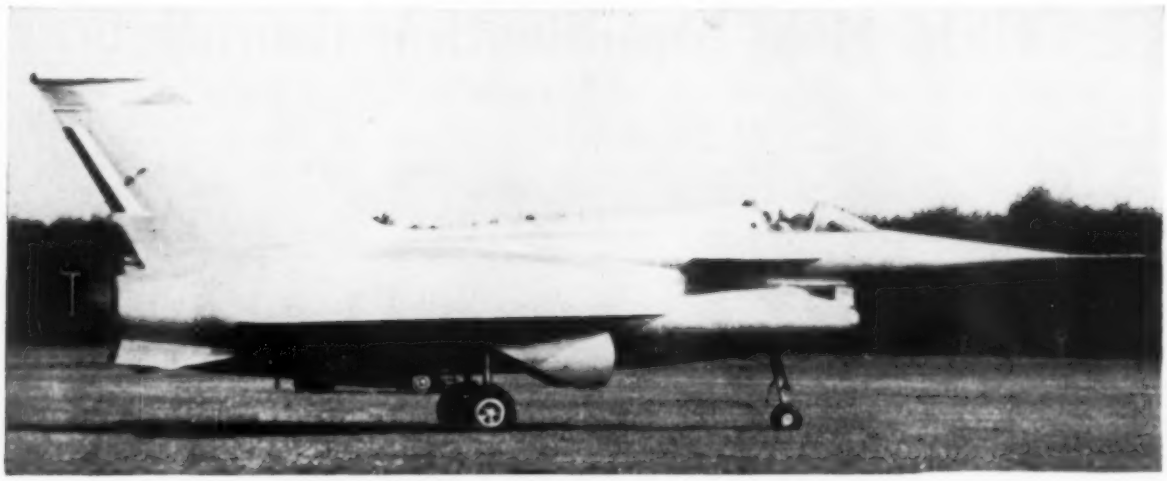
Landing areas are classified according to length, width and terrain:

- **Class I**—Usable terrain at least 2,000 ft. long and 400 ft. wide, smooth enough for an element to land in echelon with 30 seconds between each echelon.
- **Class II**—At least 2,500 ft. long and 100 ft. wide. Terrain conditions suitable for landing aircraft at 15 second intervals.
- **Class III**—At least 2,000 ft. long and 40 ft. wide. Terrain suitable for landing aircraft at 30 second intervals.
- **Class IV**—Other landing areas that may be used for assault operations, including highways and areas with unusual terrain features.

Dispersed Taxi, Takeoff

During Exercise Sagebrush the 309th perfected a technique of dispersed taxiing and takeoff for maximum protection against enemy fire. In the SOP, this procedure now has been defined:

- **Runway marshalling.** Aircraft line up on the runway, taking alternate right and left sides. Takeoff at 15-second in-



Nord Griffon: New French Interceptor

Nord Griffon is latest French interceptor, designed for vertical climb and a level flight speed of Mach 1.3. Most unusual feature of the tiny plane is the nose-mounted horizontal control surface of the slab type. Powerplant is a Snecma Atar 101-G rated at about 9,700 lb. thrust with afterburner. Gross weight of the Griffon is about 9,000 lb. Cockpit is mounted above the straight-through duct which feeds the engine. For takeoff, two Rato units can add another 2,400 lb. of thrust each for a total of almost 14,000 lb. The Griffon made its first flight Sept. 20, 1955; it was developed by the firm of Sfecmas which has since merged with Sncan to form Nord-Sfecmas. Design was originally called the Guepard. The aircraft is in a class with the Trident, Durandel and Mirage.

tervals unless weather makes this impracticable.

• **Dispersed marshalling.** Aircraft taxi at 300-ft. intervals, approaching takeoff point at 15-second intervals.

For mass landings, the pilots time departure from an Initial Point to reach an Assault Point at a prescribed time. At the AP, they head for the landing area by the sharpest angle possible, touch down and get out of the way as quickly as possible. The ground pattern depends on the field and number of planes that must be unloaded.

Landing Procedures

At Sagebrush the aircraft maintained at least 500 ft. on the cross-wind leg, wheels down, completed the turn to final almost over the field. Then with flaps down and throttles closed, the planes came in with a dive at a 40-degree angle. The final steep approach helps keep the plane above small arms fire from the perimeter of the field.

Whenever possible, the planes unload with engines running and take off without taxiing back, preferably along a parallel strip. In some areas they can land short, unload and takeoff straight ahead.

In reverse thrust landings on unfinished fields, it is routine for the pilot to turn off from 500 to 800 ft. from the end of the runway. Normally, brakes are not used until the pilot is ready to head for his unloading point.

Figures from Sagebrush show that in a 14-minute period, 10 C-123's landed on a short dirt strip, unloaded 96,000 lb. of cargo and took off again. On return trips, casualties were carried out. There is room for 40 litters.

Weapons Handling

In training, the 309th has handled 105 and 155-mm. guns, personnel carriers, jeeps, trailers and road machinery.

The items can be unloaded in 45 seconds to three minutes. Maximum personnel load is 60 men.

At Sagebrush it was possible to keep up an incoming flow of aircraft at 800 ft. while the departing pilots flew out at 500 ft. This permitted fighters to beat up the corridor, while the transports stayed high enough to escape small arms fire and too low to be a good target for radar-directed anti-aircraft fire.

The C-123 can be equipped with armor plate around the cockpit to protect the crew from small arms fire. The plate is removable.

A major maintenance advantage of the C-123, according to Col. Bentley, is that it is not tied to a fixed main base except for major overhauls and repairs. Most maintenance can be done in the field with minimum tools and equipment.

But the proof of the pudding will be tasted by the Army. Col. Bentley points out that it costs $5,000 to train a paratrooper and $2,000 a year to keep him ready for action. The 309th feels it is ready to show that the paradrop is practical only for the specialized mission, that the GI can be landed at the scene of battle without the peril of floating in on silk.

C-133A Will Carry 25-Ton Load 3,500 Mi.

Los Angeles—The mammoth turboprop-powered Douglas C-133A freighter will be able to haul a 25-ton payload 3,500 nautical miles and a 50-ton payload more than 1,000 nautical miles, Douglas Aircraft Co. reported last week.

In addition to the freighter model (AW Feb. 6, p. 26), Douglas also is submitting a proposal for an air-evacuation version of the plane designed for the Military Air Transport Service. Installation of 200 seats will be possible.

Design gross of the C-133A is 255,000 lb.; design useful load, 145,583 lb.; empty weight, 109,417 lb. A 10,000-ft. cabin altitude is maintainable in the pressurized cabin at 35,000 ft.

The high wing and high nacelles give the aircraft better longitudinal stability than its predecessor, the C-124 Globemaster. Also, a larger vertical tail area gives the C-133A a higher degree of directional stability than the C-124, while the greater horizontal tail area helps the plane resist changes in pitch attitude.

The horizontal tail position has been designed to give the C-133A good stall characteristics and provide stall warning in the form of buffeting as the horizontal tail becomes immersed in the wing wake.

A flaps-down stall approach will produce tail buffeting about eight knots before the stall. With flaps up, buffeting will occur at about 15 knots before the stall.

GM Held Most Mobilization Contracts

Washington—General Motors Corp. heads the list of the 10 top defense contractors—all doing substantial aircraft business—who held 31.3% of the nation's military contract awards from the start of mobilization in mid-1950 through mid-1955.

These firms handled over $38.5 billion of the total military orders of $123.3 billion during the five-year period:

General Motors Corp., $6,874 million; Boeing Airplane Co., $5,527.8 million; United Aircraft Corp., $4,198.8 million; General Electric Co., $4,003.2 million; Douglas Aircraft Co., $3,909.6 million; North American Aviation, $3,486.2 million; General Dynamics Corp., $3,109.6 million; Lockheed Aircraft Corp., $3,109.6 million; Curtiss-Wright Corp., $2,221.4 million; Republic Aviation Corp., $2,209.1 million.

The Defense Department released three lists showing the volume of business of the 100 largest contractors for the period from mid-1950 through mid-1955; for the period from mid-1953 through mid-1955, and for the first six months of 1955.

Pointing out that most of the work contracted for prior to 1953 has now been completed and that the following period, up to 1955, was readjustment involving extensive cancellations and program revisions, the Department said the list covering the first half of 1955 is "more representative of current peacetime procurement programs" (see table below).

The Department discontinued reports on the 100 top military contractors in 1954, but was directed to resume their publication by three Congressional groups: the Senate Preparedness Investigating Subcommittee; the Senate Banking and Currency Committee; and the House Small Business Committee.

The Department's first report following the Congressional request was sharply criticized by the Preparedness Subcommittee because it was dated from mid-1953.

The subcommittee charged that it was "inaccurate" and "misleading" because it ignored the large volume of military business channeled into large firms during the mid-1950 to mid-1953 period (AW Oct. 17, 1955, p. 16).

100 Largest Defense Contractors

Listed by the Defense Department according to net value of military prime contract awards in the period from Jan. 1 to June 30, 1955. (Includes subsidiaries.)

Rank	Companies	Contracts (In Millions)	% U. S. Total
1.	North American Aviation, Inc.	646.2	7.6
2.	General Dynamics Corp.	374.4	4.4
3.	Boeing Airplane Co.	368.1	4.3
4.	United Aircraft Corp.	321.3	3.7
5.	Curtiss-Wright Corp.	281.5	3.3
6.	General Electric Co.	268.8	3.2
7.	General Motors Corp.	235.0	2.7
8.	Douglas Aircraft Co.	209.1	2.5
9.	Lockheed Aircraft Corp.	193.1	2.3
10.	Ford Motor Co.	191.0	2.2
11.	Hughes Tool Co.	171.0	2.0
12.	American Telephone & Telegraph Co.	151.1	1.7
13.	Bendix Aviation Corp.	122.0	1.5
14.	International Business Machines Corp.	105.2	1.2
15.	Martin (Glenn L.) Co.	97.2	1.1
16.	Northrop Aircraft, Inc.	84.9	1.0
17.	Goodyear Tire & Rubber Co.	77.9	1.0
18.	Republic Aviation Corp.	77.9	0.9
19.	Sperry Rand Corp.	65.5	0.7
20.	McDonnell Aircraft Corp.	59.3	0.7
21.	Philco Corp.	58.0	0.7
22.	Radio Corp. of America	49.4	0.6
23.	Pomeroy (J. H.), Hawaiian Dredging	48.4	0.6
24.	Firestone Tire & Rubber Co.	45.9	0.5
25.	Hercules Powder Co.	44.2	0.5
26.	AVCO Manufacturing Corp.	43.7	0.5
27.	North Atlantic Constructors	41.2	0.5
28.	Raytheon Manufacturing Co.	40.4	0.5
29.	General Tire & Rubber Co.	40.3	0.5
30.	Collins Radio Co.	39.5	0.5
31.	Brown & Root, Inc.	39.3	0.5
32.	Associated Contractors	37.6	0.4
33.	General Precision Equipment Corp.	36.8	0.4
34.	Chance Vought Aircraft, Inc.	36.1	0.4
35.	Fairchild Engine & Airplane Corp.	35.1	0.4
36.	Olin-Mathieson Chemical Corp.	33.1	0.4
37.	Standard Oil Co. (N. J.)	32.0	0.4
38.	Burroughs Corp.	31.8	0.4
39.	Standard Oil Co. (Calif.)	31.6	0.4
40.	Gilfillan Bros., Inc.	30.1	0.3
41.	Bell Aircraft Corp.	29.2	0.3
42.	U. S. Rubber Co.	27.3	0.3
43.	Consolidated Diesel Electric Corp.	26.8	0.3
44.	Texas Co.	26.7	0.3
45.	ACF Industries, Inc.	26.0	0.3
46.	Lear, Inc.	25.9	0.3
47.	Hayes Manufacturing Corp.	25.4	0.3
48.	Morrison-Knudsen Co., Inc.	24.5	0.3
49.	Cities Service Co.	24.2	0.3
50.	Piasecki Helicopter Corp. (Vertol)	23.5	0.3
51.	Phillips Petroleum Co.	23.1	0.3
52.	Eastman Kodak Co.	23.0	0.3
53.	Hazeltine Corp.	22.4	0.3
54.	Sundstrand Machine Tool Co.	20.7	0.2
55.	American Machine & Foundry Co.	20.4	0.2
56.	Motorola, Inc.	19.5	0.2
57.	Du Pont de Nemours & Co.	19.0	0.2
58.	American Bosch Arma Corp.	18.5	0.2
59.	Minneapolis-Honeywell Regulator Co.	18.3	0.2
60.	Newport News Shipbuilding & Dry Dock Co.	17.1	0.2
61.	Bethlehem Steel Corp.	17.0	0.2
62.	Tide Water Associated Oil Co.	16.9	0.2
63.	International Harvester Co.	16.4	0.2
64.	American Ship Building Co.	16.3	0.2
65.	Continental Motors Corp.	16.2	0.2
66.	McKee General Contractors, Inc.	15.6	0.2
67.	Westinghouse Electric Corp.	14.8	0.2
68.	Kiewit Sons Co.	14.6	0.2
69.	States Marine Corp.	14.5	0.2
70.	Bateson (J. W.) Co., Inc.	14.2	0.2
71.	Reed Construction Co., Inc.	13.8	0.2
72.	Todd Shipyards Corp.	13.8	0.2
73.	Garrett Corp.	12.8	0.2
74.	Gulf Oil Corp.	12.5	0.2
75.	Pittsburgh-Des Moines Steel Co.	12.4	0.2
76.	Northern Pump Co.	12.4	0.2
77.	Gar Wood Industries	12.2	0.2
78.	Massachusetts Institute of Technology	12.2	0.1
79.	Fletcher Aviation Corp., Inc.	11.8	0.1
80.	Baldwin-Lima-Hamilton Corp.	11.7	0.1
81.	Thiokol Chemical Corp.	11.6	0.1
82.	Avondale Marine Ways, Inc.	11.6	0.1
83.	American Safety Razor Corp.	11.5	0.1
84.	Standard Coil Products Co.	11.0	0.1
85.	Fuller Co.	11.0	0.1
86.	Day & Zimmerman, Inc.	10.8	0.1
87.	Mason & Hanger—Silas Mason Co., Inc.	10.4	0.1
88.	Merritt-Chapman & Scott Corp.	10.4	0.1
89.	Bateson (T. C.) Construction Co.	10.2	0.1
90.	U. S. Steel Corp.	10.1	0.1
91.	Stolte, Inc.	10.0	0.1
92.	Continental Oil Co.	9.8	0.1
93.	Loral Electronics Corp.	9.5	0.1
94.	Socony Mobil Oil Co., Inc.	9.4	0.1
95.	Lewyt Corp.	9.3	0.1
96.	Shell Oil Co.	9.0	0.1
97.	Jones (J. A.) Construction Co.	9.0	0.1
98.	Oman Construction Co.	8.4	0.1
99.	Sinclair Oil Corp.	8.3	0.1
100.	Farnsworth & Chambers Co., Inc.	8.1	0.1
	Total 100 Companies	$5,838.0	68.4
	U. S. Total	$8,539.1	100.0

Navy Reveals Details on Petrel Missile

First official details were revealed last week on the Fairchild-built Petrel air-to-surface missile developed by the National Bureau of Standards for the Navy's Bureau of Ordnance.

The Petrel is built around a standard Navy Mk. 13 airborne torpedo. Jettisonable wings, tail, powerplant and nose guidance packages have been added. A Fairchild-developed J44 turbojet rated at 1,000 lb. static thrust powers the missile.

Approximate dimensions for the Petrel:

- **Length, 24 ft.**
- **Wingspan, 13 ft.**
- **Tail span, 8 ft.**
- **Diameter of the body, about two ft.**

Detachable parts are of conventional makeup with the exception of the large triangular fins. They are sheet metal stampings with honeycomb stiffening inside. Metal bonding techniques fasten the assembly.

The Petrel is air-launched from patrol aircraft well outside the range of enemy anti-aircraft. The Navy announcement said the missile has an active homing system that guides the missile to the target.

As the Petrel approaches within normal topedo range of the target, its height above the surface of the water is checked by a radio altimeter in the package under the nose guidance section. At the proper altitude for a drop, a signal from this altimeter jettisons the detachable parts. The stripped torpedo makes a normal drop into the water and runs to the target.

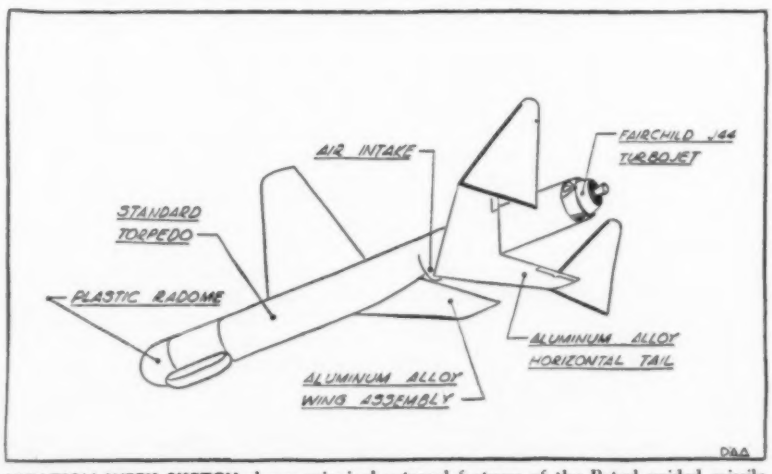
During the Petrel test program, the powerplant is recovered by a parachute deployed from the cylinder visible under the horizontal tail.

Tests and evaluation of the Petrel were completed by Bureau of Ordnance at the Naval Ordnance Test Station, Chincoteague, Va., and later by the Fleet Operational Development Force. During the tests, ". . . The missile performed with a degree of reliability considered exceptionally high for such a sophisticated weapon," the Navy said.

The Petrel is the successful culmination of a series of missiles named after water birds and developed under technical direction of the Navy by the Bureau of Standards. Among earlier missiles were the Kingfisher, Plover and Grebe. Basic mission of all these missiles was the same, air-launched, they were directed against shipping or shallow-water targets.

Petrel is in production at the Fairchild Guided Missiles Division plant, Wyandanch, Long Island, N. Y.

PETREL PATROL: Navy Lockheed P2V Neptune on test-firing mission (above and below) has Fairchild Petrel air-to-surface guided missile slung underneath each wing.



AVIATION WEEK SKETCH shows principal external features of the Petrel guided missile.

ASPR Will Eliminate Fixed Overhead Rates

Washington—In compliance with a ruling of the Comptroller General, Defense Department is revising procurement procedures to eliminate predetermined fixed overhead rates from cost-reimbursement contracts.

New rules will be effective as an amendment to the Armed Services Procurement Regulations by July 1. After that date, it is proposed that overhead costs will be on an actual basis, with contractors submitting claims for overhead that will be subject to negotiation.

Fixed overhead rates in existing contracts will be allowed to run for the period stipulated in the contracts. Later, Defense Department said, overhead will be negotiated on the basis of after-the-fact costs and incorporated into the contract. When an estimated rate is used, it will be subject to adjustment when experience has been obtained.

Industry is understood to feel that the new system may entail excessive auditing costs.

Some '55 Aircraft Profits Show Drop

Three major aircraft manufacturers—Martin, Bell and Chance Vought—reported lower profits for 1955 than for the record post-war year 1954. Republic, reporting an increase in profits, said it expects both sales and profits to decline in 1956 and 1957. Vertol reported the best year in its history and Curtiss-Wright showed an increase in profits of more than $15 million.

Bell Aircraft Corp.

Bell's net profit for 1955 was $5,914,482 ($2.25 a share) compared to $6,404,243 in 1954. Sales were $204,440,543—a new record—compared to $185,646,114 in 1954. Helicopter sales amounted to $48 million. Commercial sales accounted for 14% of total sales and 35% of net income. Over 75% of the company's scientific and technical effort was devoted to "guided missiles and related work," Bell said. Greatest single effort in the technical field was spent on the Air Force GAM-63 air-to-surface Rascal missile. Bell's contract backlog now is $246,840,268. In 1955 Bell's work included delivery of the X-2 stainless steel supersonic research plane to USAF; receipt of a USAF contract to build a jet-powered VTOL plane; unveiling of its tilting-rotor XV-3 Army convertiplane; delivery of the first Ballairus 47H helicopters and continued volume production of the tandem-rotor Navy HSL helicopter.

Glenn L. Martin Co.

The Martin Co. reported a net income of $13,285,297 for 1955—almost $7 million below 1954—but said its financial position now "is stronger than at any time in the past."

Sales totaled $271,862,342 compared to $270,730,000 in 1954, although income before taxes was $3 million higher than for 1954. Because of costs and losses in earlier years, some $19 million had been available in 1954 to reduce book income otherwise subject to income taxes. Earnings amounted to $4.92 a common share and to 4.9% of sales. Dividends totaled $1.50 a common share plus a dividend of 5% payable in stock.

Backlog of contracts, some of them running into 1959, amounted to $600 million, an increase of $60 million. The company said the P6M SeaMaster, the advanced TM-61 Matador missile and other undisclosed projects are "now close to the production stage." The backlog includes "four major aircraft projects, five major missile projects and two major electronic projects," the company said. Presumably these include the P6M, the B-57, the P5M Marlin seaplane and a design competition for a tactical bomber; the Bullpup, Lacrosse, Matador, Vanguard and Titan missiles, and the Missile Master system for coordinating fire of Nike batteries.

In 1955 Martin became the prime contractor for a rocket designed to carry an earth satellite to altitude and launch it upon its earth-circling orbit and the prime contractor for USAF's second intercontinental ballistic missile, the Titan, to be built in a $10 million facility at Denver, Colo. Martin also formed a subsidiary, RIAS, Inc., to do basic research in the physical sciences. A small staff is at work and land has been acquired between Washington and Baltimore for a laboratory.

Martin expects "some growth in sales volume" in 1956 but expects net profit as a percentage of sales to be lower "because of non-recurring items taken into income in 1955."

Chance Vought Aircraft, Inc.

Chance Vought reported net profits of $4,759,544 on sales of $147,095,440 in 1955. Profits were down almost $2 million and sales were down by $2.5 million, partly due to the phasing out of production of the F7U-3 twin-jet Cutlass Navy fighter and initial costs related to Crusader F8U production.

Profits amounted to 3.2% of sales, compared to 4.4% in 1954 and to $4.41 per common share, compared to $6.15 the year before.

A backlog of $214 million—some $26 million higher than in 1954—includes $134 million for the Crusader and $50,488,000 for the Regulus, which in 1955 became the Navy's "first operational offensive missile," the company said.

Satisfactory development of the Regulus program have led to "orders for a supersonic, highly advanced" attack missile for the Navy. A new low-speed wind tunnel went into operation early in 1955 and late in the year Chance Vought scheduled addition of a $3 million high-speed tunnel.

Like Martin, Chance Vought has set aside no reserve for renegotiation, considering its profits to be well within reasonable limits.

Republic Aviation Corp.

Republic last year made a profit of $14,731,134 on sales of $547,387,242, compared to a profit in 1954 for $8,976,523 on sales of $323,456,601. In spite of the $6 million increase in profits, President Mundy I. Peale said 1956 and 1957 sales and net income are expected to be lower because of changeovers to newer models of supersonic jet fighter-bombers. Profits amounted to $10.01 a share compared to $6.71 in 1954, with adjustments for a 10% stock dividend.

Production of the photo reconnaissance RF-84F Thunderflash will end this year and production of the F-84F Thunderflash will end in 1957. The supersonic F-105 fighter-bomber, now being manufactured, should be in volume production in 1958, Republic said. Production of an RF-105 also is planned.

Republic also has USAF contracts for development and construction of the XF-103 fighter-interceptor and another fighter-bomber which it said USAF will consider for procurement in 1960-65. Republic's expansion of research and development calls for expenditures of $12 million in 1955 and 1956.

Curtiss-Wright Corp.

Curtiss-Wright reported $35,081,045 in profits for 1955 on sales of $508,703,445. Sales were $34 million higher and profits $15,703,766 higher than in 1954. Backlog of contracts was $601 million, $61 million less than 1954. Forty percent of net earnings came from commercial sales. Dividends paid were $2 a share on Class A stock and $1.75 on common. In 1955 Curtiss-Wright established an advanced research and development center at Que-

Gen. Wood Killed

Baltimore, Md.—Maj. Gen. Floyd B. Wood, 47, Deputy Commander of the Air Research and Development Command, was killed here last week when the T-33 jet trainer he was piloting crashed and burned shortly after take-off from Friendship Airport.

Gen. Wood had been with ARDC since its organization in 1951, when he became Chief of Staff at the Wright Air Development Center. At the time of his death he was chief of the command's research and development program. He was scheduled to take over command of the ARDC Flight Test Center at Edwards AFB in June.

Gen. Wood was widely recognized both in the Air Force and by the aircraft industry as one of the pioneers in the efforts to increase the pace of aeronautical development and establish an adequate research program for USAF. Gen. Wood was a command pilot and was commissioned in the Air Force in 1929 after completing flight training at Brooks and Kelly fields. He was a graduate of North Texas State Teachers College and had a master's degree in meteorology from Massachusetts Institute of Technology.

hanna, Pa., acquired Propulsion Research Corp. of Santa Monica, Calif. and established a turbomotor division.

Vertol Aircraft Corp.

Vertol, formerly Piasecki Helicopter Corp., had record earnings of $1,550,937 ($3.32 a share) in 1955, on sales of $57,690,074 (an increase of 18% over 1954). The company concentrated on production of the 20-passenger H-21 Work Horse for the armed services, and on research and development aimed at VTOL aircraft. Backlog increased from $100 million to $125 million. Working capital was increased 26%, stockholders' equity by 29% and long-term indebtedness was reduced 38%. Employes increased from 1,469 to 4,995. Work continued on conversion of the 40-passenger YH-16 into the YH-16B turbine transport helicopter. The YH-16A crashed last year near the end of its flight test programs when an item of special test equipment failed.

Kaman Aircraft Corp.

Kaman reported $428,815 in profits on $14,503,869 in sales, the highest in its 10-year history, in spite of a stretchout in production of the Navy HOK-1 helicopter which necessitated a cut in staff of 125 employes. Profits for 1954 were $344,046 on sales of $13,395,242. Work on 18 research and development contracts includes an annular-wing aircraft project, follow-on contracts for remote controlled helicopters, and a specialized application of the roto-chute principle. Kaman formed a military operations research division in 1955.

Pacific Airmotive Corp.

PAC lost $817,410 in the year ending Nov. 30, 1955, compared to a loss of $128,338 the year before. Sales were $19,279,537 compared to $16,531,086 in 1954. PAC blamed the loss primarily on the fact that costs for its USAF C-54 IRAN (inspection and repair as necessary) program were "very substantially in excess of the contract price," but said it hopes to recover some of this.

Lear, Inc.

Lear had the highest sales in its history last year—$54,600,273 compared to $54,435,637 in 1954—but profits declined from $2,305,727 in 1954 to $2,115,811. Lear blamed the decrease on a work stoppage at its Grand Rapids Division in the last two months of 1955. Backlog increased 41% to $53,459,922. Net worth was increased by 21% and working capital by 27%. Output in most product lines. Lear devoted a major research effort to advanced automatic flight control systems and flight reference instruments applicable to missiles, drones, helicopters and high-performance aircraft.

Defense Directive Authorizes Release of Weapons Information

Washington—Defense Department has issued a new directive aimed at reversing the Eisenhower Administration's attempted blackout on weapons information.

Directive 5230.12 spells out what can be told about aircraft, engines and missiles at each point in their production and operational history.

It does not say the facts must or will be released, but authorizes release if the Office of Security Review approves it.

The schedule contained in the directive does not differ basically from the one used by the Air Force before the White House issued its often-violated edict against disclosure of weapons information.

With some modification, the USAF program now will be used by all three services.

Defense Department spokesmen emphasized that the new directive is not intended to further curtail release of information.

Instead, they said, it defines what can be considered for release in such a way that it will be difficult for arbitrary or technically incompetent officials to withhold information.

For example, the directive makes it clear that information previously released can be re-released without further approval.

Some Delay Seen

The armed forces have 30 days to implement the directive, but Pentagon observers doubt that it will be enforced until after the election and the current arguments over the defense program and budget are finished.

In recent weeks there has been a series of disclosures on the capability of new weapons, some of which brought heated protests from the White House. Last week came news that the Northrop Snark, jet-propelled guided missile has flown 2,000 miles. For its design mission, the missile must fly 5,000 miles.

Security review officers hailed the new directive as an aid in their work and a guide to defense contractors. Once in full force, it will speed decisions and make it possible for Security Review to handle its problems without repeated reference to the higher authority, they say.

The directive provides for exceptions to the rules. When a case cannot be resolved on the basis of the rules, it will be decided on its own merit by the Secretary of Defense. Individual decision also will be made for weapons that have been cancelled, discontinued or completed.

How It Works

For aircraft and engines, the directive divides history into four phases roughly covering design, first production, delivery to combat units and full delivery.

In the case of engines, the latter two phases come with the 50-hour and 150-hour qualification tests.

Provision is made for release of model designation, manufacturer, external pictures, models and performance in generalities. For the most part, the rules do not differ from the ones in force before R. Karl Honaman served his brief term as Deputy Assistant Secretary, attempting to enforce a stringent blackout on information.

In the case of guided missiles, the directive provides only three phases of development and production. The first authorized release of information will come at the start of production, when model designation and manufacturer can be disclosed, along with general performance, the power plant and launching information. External photos are permissable.

On the issue, USAF has been more liberal, favoring a fourth phase in the directive, with release of more information. Navy voiced strong objections, and the other services agreed in the interest of developing the initial directive.

Real importance of the new directive depends on how it is carried out. Actually, it was made necessary when the Administration abolished the "restricted" classification publicly while they privately launched an effort to withhold considerably more information than the "restricted" label dealt with.

Under the new directive, classification remains a responsibility of the service secretaries and theoretically is unrelated to the decision to release information. It follows that if release of a classified item is justified, the cognizant service will be under pressure to lower the classification of the whole contract.

Gas Turbine Meeting

The gas turbine power division of the American Society of Mechanical Engineers will hold its first annual conference and exhibit at the Statler Hotel in Washington, D. C., next Monday, Tuesday and Wednesday.

Industry Report on Salaries, Bonuses

Tables of salaries and bonuses totaling more than $25,000 annually as reported by five aircraft companies to House Armed Services Investigating Subcommittee are shown below:

McDonnell Aircraft Corp.

(Year Ended Dec. 31)	Salary 1952	Bonus	Salary 1953	Bonus	Salary 1954	Bonus	Salary 1955	Bonus
James S. McDonnell, Jr., President and Chairman of the Board	$58,130	.....	$65,210	.....	$66,055	.....	$73,297	.....
Robert H. Charles, Vice President	26,700	.....	35,092	.....	41,454	.....	46,923	.....
C. Warren Drake	30,789	.....	34,954	.....	37,520	.....	41,400	.....
Kendall Perkins	24,359	.....	29,834	.....	32,251	.....	36,244	.....
John F. Aldridge, Jr.	.....	.....	.....	.....	21,208	.....	23,680	.....
Garrett C. Covington, Jr.	.....	.....	23,968	.....	25,214	.....	28,679	.....
Don R. Berlin	50,386	.....	.....	.....	.....	.....	.....	.....
William A. Roth	.....	.....	24,395	.....	25,500	.....	.....	.....
W. R. Orthwein, Jr.	.....	.....	.....	.....	.....	.....	21,402	.....
TOTAL	$190,364	.....	$213,453	.....	$249,202	.....	$271,625	.....

Lockheed Aircraft Corp.

(Year Ended Dec. 31)	Salary 1952	Bonus	Salary 1953	Bonus	Salary 1954	Bonus	Salary 1955	Bonus
Robert E. Gross, President	$118,800	.....	$130,680	.....	$125,928	.....	$125,928	.....
Cortland S. Gross, Executive Vice President	89,100	.....	98,010	.....	94,446	.....	94,446	8,000
C. A. Barker, Jr., Treasurer and Vice President of Finance	83,700	.....	92,070	.....	88,722	.....	88,722	.....
Cyril Chappellet, Vice President, Administration	64,800	.....	71,280	.....	68,688	.....	65,688	4,800
D. J. Haughton, Vice President & General Manager, Ga. Div.	35,166	.....	80,588	.....	70,262	.....	62,000	10,042
Hall L. Hibbard, Vice President, Engineering	64,800	.....	71,280	.....	68,688	.....	68,688	4,000
Burt C. Monesmith, Vice President and Gen. Mgr., Calif. Div.	24,300	.....	78,573	.....	59,223	.....	60,000	7,400
Elwood R. Quesada, V. P. & Gen. Mgr. Missile Sys. Div.	.....	.....	.....	.....	45,770	.....	49,712	3,817
Carl B. Squier, Vice President, Sales	56,700	.....	62,370	.....	60,102	.....	60,102	.....
D. E. Browne, Comptroller	32,400	.....	54,141	.....	38,932	.....	40,000	4,750
L. W. Wolfekuhler, Secretary	23,018	.....	30,465	.....	26,162	.....	26,310	9,800
H. R. Campbell, Assistant Treasurer	31,476	.....	33,679	12,286	33,789	12,682	34,502	12,938
James V. Carmichael, Vice President	24,777	.....	.....	.....	.....	.....	.....	.....
K. V. Sampson, Assistant Secretary	22,115	.....	29,703	7,957	30,801	14,128	.....	.....
H. J. Brown, Assistant Secretary	.....	.....	.....	.....	.....	.....	21,231	12,000
R. J. Osborn, Assistant Secretary	.....	.....	.....	.....	.....	.....	20,346	.....
TOTAL	672,152	.....	832,839	20,243	811,513	26,810	820,675	77,547

Republic Aviation Corp.

(Year Ended Dec. 31)	Salary 1952	Bonus	Salary 1953	Bonus	Salary 1954	Bonus	Salary 1955	Bonus
M. I. Poole, President	$79,500	$40,739	$79,500	$32,390	$79,500	$20,000	$87,464	$20,000
W. G. Bain, Vice President	.....	.....	.....	.....	55,833	.....	63,185	14,000
L. L. Brabham, Vice President	22,090	6,561	25,000	18,738	25,000	18,739	27,458	18,800
K. Ellington, Vice President	.....	.....	.....	.....	.....	.....	24,367	9,000
A. Kartveli, Vice President	50,980	34,404	50,880	.....	51,030	.....	56,053	.....
H. Lehne, Vice President	22,083	.....	.....	.....	.....	.....	.....	.....
T. A. Murphy, Vice President	34,980	18,638	34,980	5,969	34,980	5,969	15,000	12,000
J. J. Ryan, Vice President	31,800	21,015	31,800	27,025	31,800	12,026	35,113	12,100
M. T. Scanlon, Vice President	19,080	8,833	19,650	11,359	20,000	11,358	20,000	11,400
T. Davis, Treasurer	37,100	24,853	37,100	11,961	37,100	11,962	40,859	12,000
J. A. Thompson, Secretary	.....	.....	.....	.....	.....	.....	20,000	4,500
H. C. Pillman, Assistant Secretary and Treasurer	.....	.....	.....	.....	18,485	7,945	18,500	8,700
M. G. Veckman, Assistant Secretary and Treasurer	16,960	7,116	16,960	9,151	18,417	9,200	18,500	9,600
A. R. Crawford (11/16/55), Vice President, European	.....	.....	.....	.....	.....	.....	3,125	.....
TOTAL	314,573	162,159	295,870	116,593	372,145	97,199	429,624	132,100

Douglas Aircraft Co.

	Salary 1952	Bonus	Salary 1953	Bonus	Salary 1954	Bonus	Salary 1955 (Fiscal Year Thru 11-30-55)	Bonus
Donald W. Douglas, Sr., President	$134,355	.....	$149,674	.....	$158,125	.....	$162,528	.....
F. W. Conant, Sr., Vice President	68,747	.....	93,448	.....	105,417	.....	108,519	.....
A. E. Raymond, Vice President, Engineering	60,727	.....	70,285	.....	73,791	.....	76,113	.....
Donald W. Douglas, Jr., Vice President, Military Relations	28,646	.....	37,823	.....	44,917	.....	46,794	.....
Nat Paschall, Vice President, Commercial Sales	23,463	.....	32,404	.....	39,875	.....	41,979	.....
F. E. Hines, Vice President, Finance	26,733	.....	33,981	.....	36,896	.....	38,307	.....
L. A. Carter, Vice President, Gen. Mgr., Santa Monica	29,041	.....	34,075	.....	36,896	.....	37,807	.....
T. E. Springer, Vice President and General Manager	29,041	.....	34,075	.....	36,896	.....	37,807	.....
K. G. Farrar, Vice President and General Manager	29,041	.....	26,242	.....	34,469	.....	37,807	.....
H. Woodhead, Vice President and General Manager, Tulsa	29,497	.....	34,075	.....	36,896	.....	37,807	.....
A. M. Rochlen, Vice President, Public Relations	.....	.....	.....	.....	35,880	.....	37,807	.....
H. W. Strangman, Treasurer	23,632	.....	25,255	.....	26,354	.....	27,505	.....
M. A. Kavanaugh, Assistant Treasurer and Controller	.....	.....	22,191	.....	24,979	.....	25,718	.....
L. E. Tollefson, Secretary	.....	.....	.....	.....	21,083	.....	22,515	.....
G. B. Gelly, Assistant Secretary, Wash. Rep.	.....	.....	.....	.....	22,458	.....	22,465	.....
M. E. Oliveau, European Division	24,926	.....	28,855	.....	31,020	.....	47,298	.....
TOTAL	$507,849	.....	$622,423	.....	$765,252	.....	$808,766	.....

Convair

	Salary 1952 (Year Ended Nov. 30)	Bonus	Salary 1953	Bonus	Salary 1954 (Year Ended Dec. 31)	Bonus	Salary 1955 (Year Ended Dec. 31)	Bonus
R. H. Biron, Jr., Vice President and Administrator	$35,000	.....	$38,157	.....	$35,000	10,000	$35,000	$12,500
G. T. Boyes, Treasurer	.....	.....	.....	.....	20,780	6,000	21,405	8,500
B. F. Coggan, Manager Convair, San Diego	20,093	.....	32,301	.....	29,994	10,000	32,500	16,000
La Motte T. Cohu, President and Assistant to Chm. of Board	45,000	.....	30,000	.....	.....	.....	.....	.....
A. C. Esenwein, Vice Pres. and Mgr. Convair, Ft. Worth	27,248	.....	36,284	.....	35,000	15,000	35,000	16,000
A. P. Fontaine, Executive Vice President	37,500	.....	.....	.....	.....	.....	.....	.....
C. F. Horne, Manager Convair, Pomona	.....	.....	11,356	.....	26,362	6,000	30,000	12,000
Gage Irving, Manager Convair, Pomona	25,200	.....	11,739	.....	.....	.....	.....	.....
T. G. Lanphier, Jr., Vice President and Assistant to President	35,000	.....	38,337	.....	35,000	15,000	35,000	17,500
K. F. Leaman, Manager Convair, San Diego	8,340	.....	.....	.....	.....	.....	.....	.....
J. T. McNarney, President	50,000	.....	82,090	.....	75,000	25,000	62,500	30,000
L. W. Miller, Vice President, Finance	35,000	.....	35,180	.....	.....	.....	.....	.....
J. V. Naish, Executive Vice President	35,000	.....	50,657	.....	45,000	25,000	52,500	27,500
F. B. Odlum, Chairman of Board	.....	.....	24,000	.....	135,000	(Compensation as Ch. of Board For 5 Years From Nov. 20, 1947 to Nov. 30, 1952)		
W. C. Rockefeller, Executive Assistant to Chm. of Board	35,000	.....	33,722	.....	.....	.....	.....	.....
R. O. Ryan, Vice President, Manufacturing	32,083	.....	.....	.....	.....	.....	.....	.....
R. B. Watts, Vice President and General Counsel	38,000	.....	41,587	.....	38,000	10,000	38,000	12,500
R. C. Sebold, Vice President, Engineering	35,000	.....	37,917	.....	35,000	7,500	35,000	12,500
D. T. Fisher, Controller	.....	.....	2,082	.....	25,000	7,500	25,000	9,000
TOTAL	$493,464	.....	$505,589	.....	$535,136	$137,000	$401,905	$174,000

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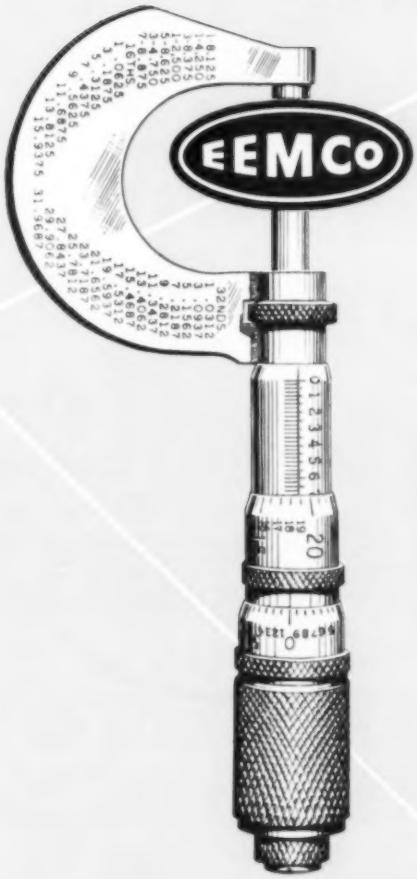

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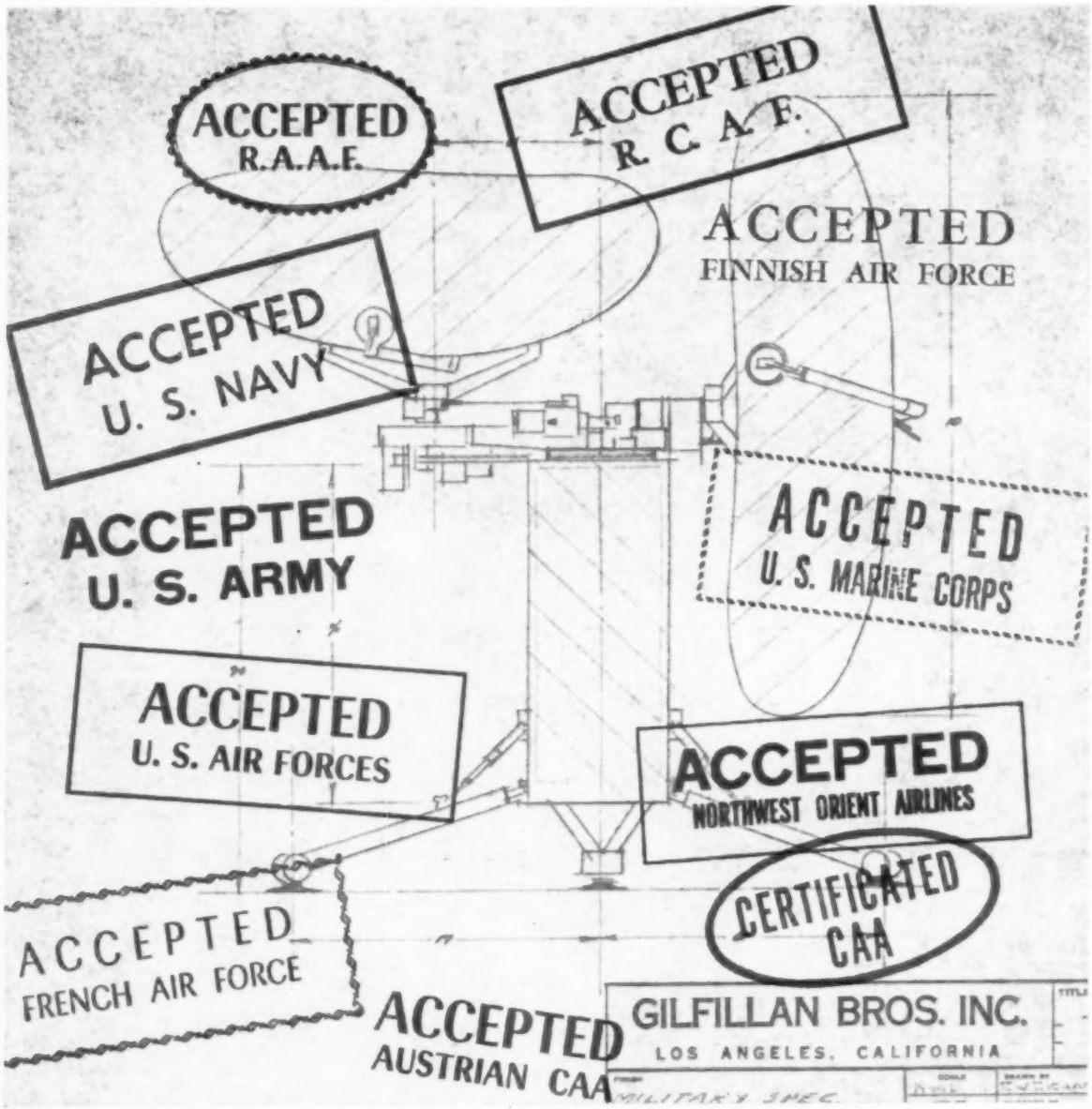

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Skyray Gets Catapult Trial

ENVELOPED IN CLOUD of steam, Douglas F4D-1 Skyray begins steam-catapult takeoff from the Naval Air Test Center, Patuxent River, Md., in carrier reliability trial.

WITH WING SLOTS down and flames pouring from its afterburner, the bat-winged Skyray rears up for takeoff near the end of its steam-catapult run.

UNLEASHED from the launching hook and airborne, the F4D roars away from the launching site. The Skyray is scheduled to become operational aboard the USS Forrestal.

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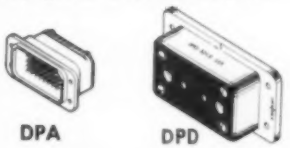

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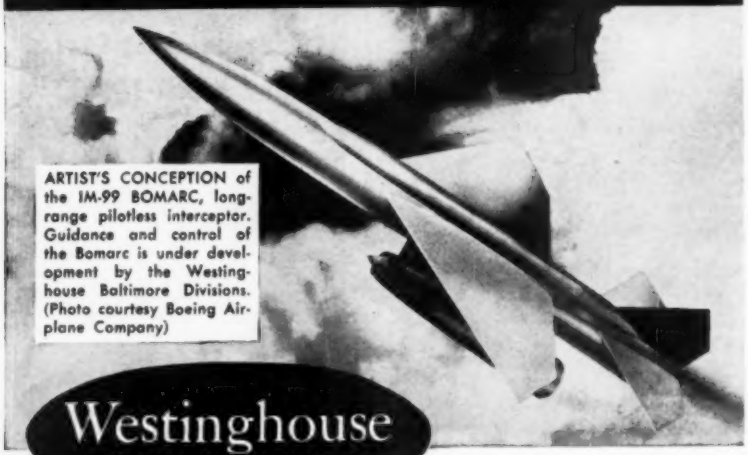

ARTIST'S CONCEPTION of the IM-99 BOMARC, long-range pilotless interceptor. Guidance and control of the Bomarc is under development by the Westinghouse Baltimore Divisions. (Photo courtesy Boeing Airplane Company)

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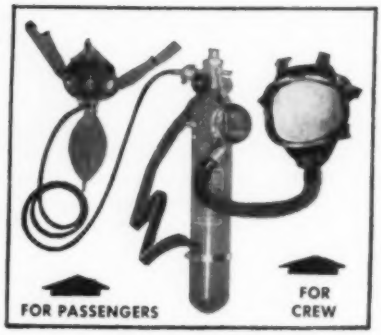

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TWA, PanAm Mail Pay Cut in Offset Case

Washington—Trans World Airlines and Pan American World Airways both have to return mail pay to the government under terms of the final decision in the Trans-Atlantic Final Mail Rate Case. The decision, which settles the offset issue, sets mail pay for an eight year period starting in 1946.

The decision is the final move in the long and complex case. The Civil Aeronautics Board issued decisions in the case in 1954 and 1955, but left the offset question for later action. The Supreme Court issued its offset interpretation of the law while the case was nearing completion.

The Board said its final decision cuts the government's mail pay obligation to the two carriers about $20 million below what it otherwise would have been. The final rates produce $11.4 million less than the carriers were assigned under previous temporary rates.

Combining its offset findings with previous rates, the Board determined that overpayment amounts to $7,561,000 for TWA and $3,875,000 for Pan American. At the same time, final mail pay for American Overseas Airlines between 1946 and 1950 was set and the carrier was awarded $4,947,000 over what it received with temporary rates.

Since AOA has merged with Pan American, the payment will go to Pan American. Combining the AOA payment with the PAA refund leaves Pan American with a net gain of $1.1 million.

During the period from the start of Transatlantic operations on Feb. 5, 1946, to the end of 1953, the Board found that TWA had $4,183,000 in earnings available for offset. The carrier's international need was set at $43,534,000—or $7,561,000 less than it actually received. Actual repayment will be less than that differential because of the income tax adjustments.

The Board found that Pan American's Pacific, Alaska and Latin-American divisions had earnings of $6,186,000 available for offset during the period Jan. 1, 1946, to Dec. 31, 1953. Final mail pay for Pan American's Atlantic operations in the period was set at $79,784,000, a decrease of $3,875,000 from payment under temporary rates.

The CAB also rejected attempts of TWA to get reconsideration of a disputed deferred tax issue. CAB members Chan Gurney and Harmar D. Denny would have allowed TWA to argue its case, but the motion failed for want of a majority. The Board also dismissed a motion to disqualify Chairman Ross Rizley from participation in the case.

United Protests

United Air Lines is protesting American Airlines' plan to introduce DC-7 Royal Coachman coach service on nonstop flights from New York and Washington to Los Angeles.

United told the Civil Aeronautics Board American's proposed luxury features differ materially from the Board's concept of coach service. United contends that using the DC-7 will upgrade coach service, "result in a competitive 'giveaway' race for both coach and first class traffic . . . so obscure or eliminate the distinction between first class and coach service as to result in unjust discrimination against regular fare passengers" and "may well lead to a general breakdown of the domestic industry fare structure."

New British Bomber

London—The Ministry of Supply announced this week that it has placed a development contract with A. V. Roe & Co. for a 1,500 mph. jet bomber to replace the Avro Vulcan and Handley Page Victor sometime in the early 1960s. The new bomber, to be comparable in size to the Vulcan, is expected to have a combat range of approximately 5,000 miles.

CAB Will Consider NWA Bid for Permanent Route

Washington—The Civil Aeronautics Board has refused to include Northwest Airlines in the reopened Trans-Pacific Renewal Case, but it has assured the airline of quick action on its new bid for permanent international certification.

Northwest had asked the CAB to resubmit the permanent certification issue to the President when it sends the White House a new decision on Pan American World Airways' application for a Great Circle route to the Orient.

The Board pointed out that the White House had limited the reopened case to the issue of Pan American's application and thus Northwest's request couldn't be included.

But the Board set Northwest's permanent certification application for prehearing conference in an independent proceeding. The Board said it is clear that subsidy was a crucial issue in the President's original decision to renew Northwest's certificate for seven years instead of permanently. Since NWA is now off subsidy, the CAB feels the airline should have an immediate opportunity to present its case.

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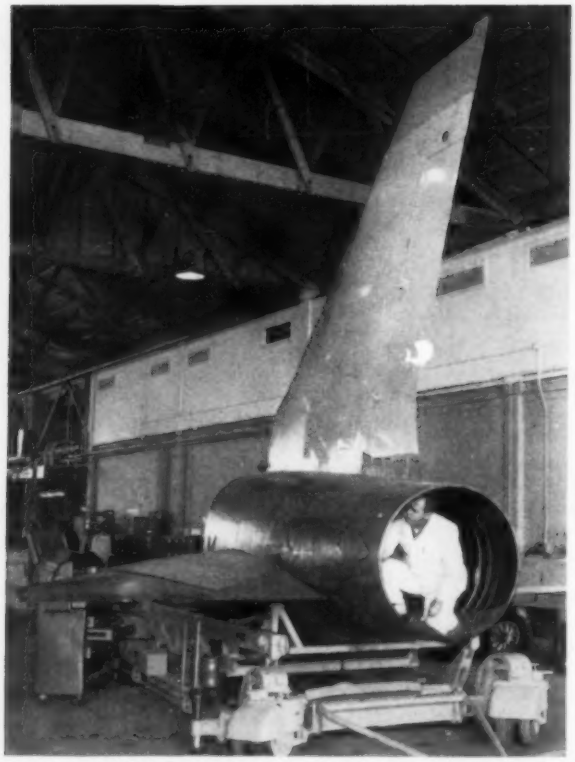
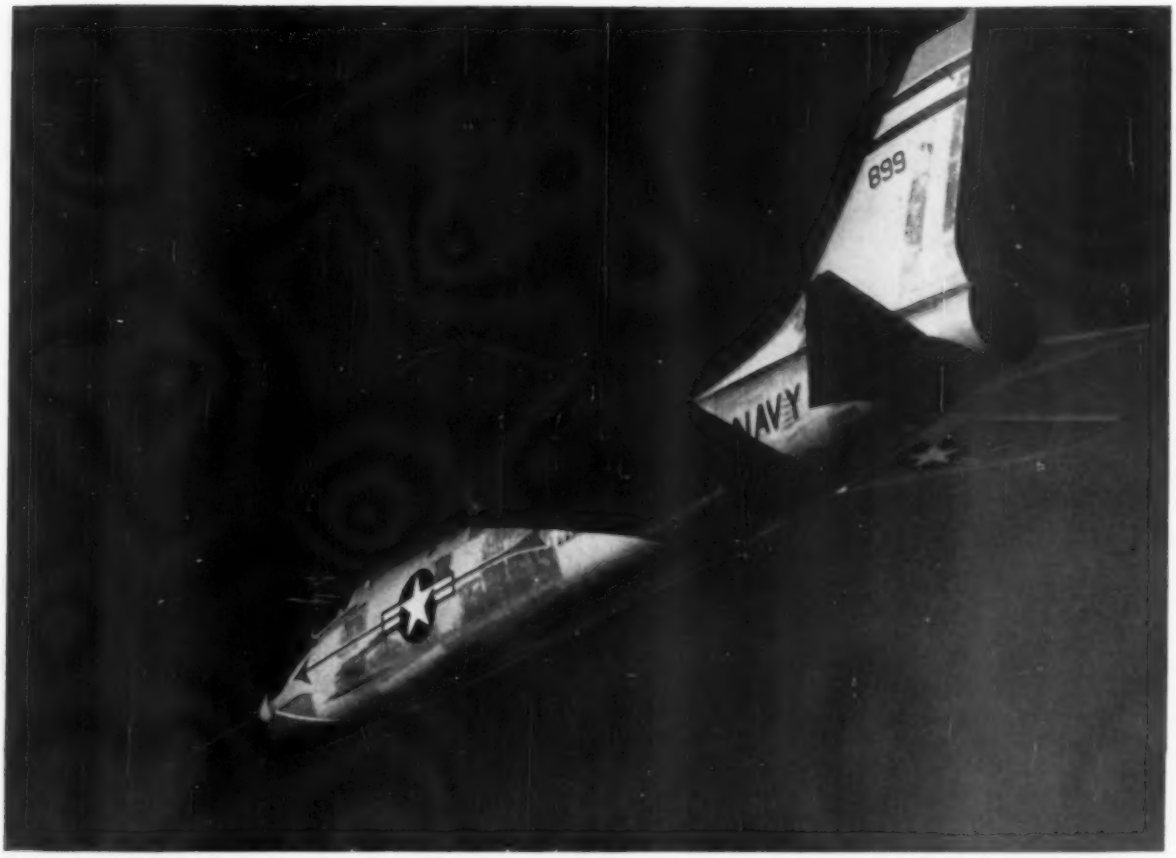


CHANCE VOUGHT AIRCRAFT inspector checks titanium in after section of the Navy's F8U-1 Crusader. Note the size of vertical tail.

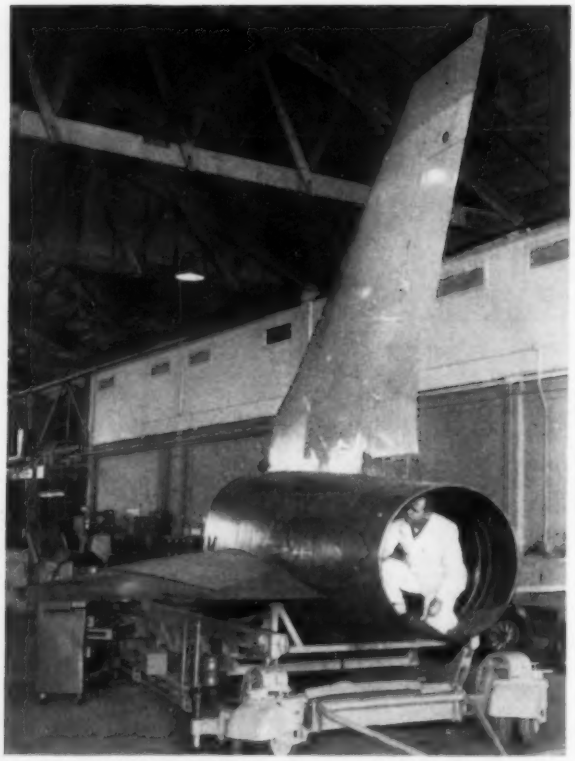
New Design Details Of Chance Vought F8U

NAVY ARTIST'S drawing depicts F8U as it would appear in combat. Folding-fin rockets probably have been fired from belly tray.



PENCIL-LIKE FUSELAGE and thin wings of the Crusader are highlighted by this in-flight view of the supersonic Navy interceptor.

CRUSADER'S variable incidence wing, upper left, suggests wing's leading edge jacks up, pivots around rear spar.



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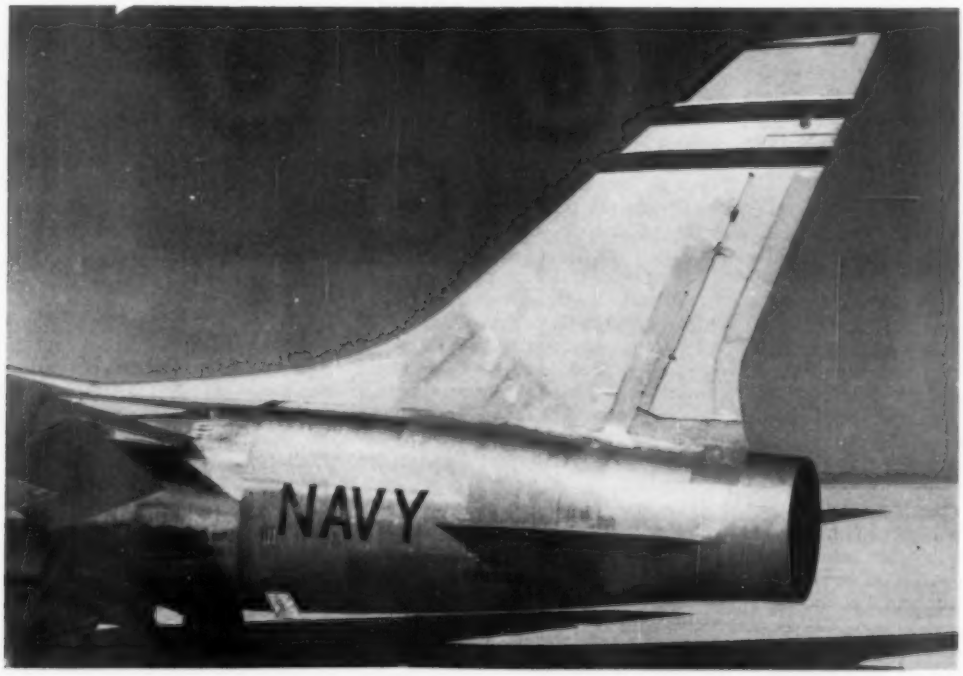

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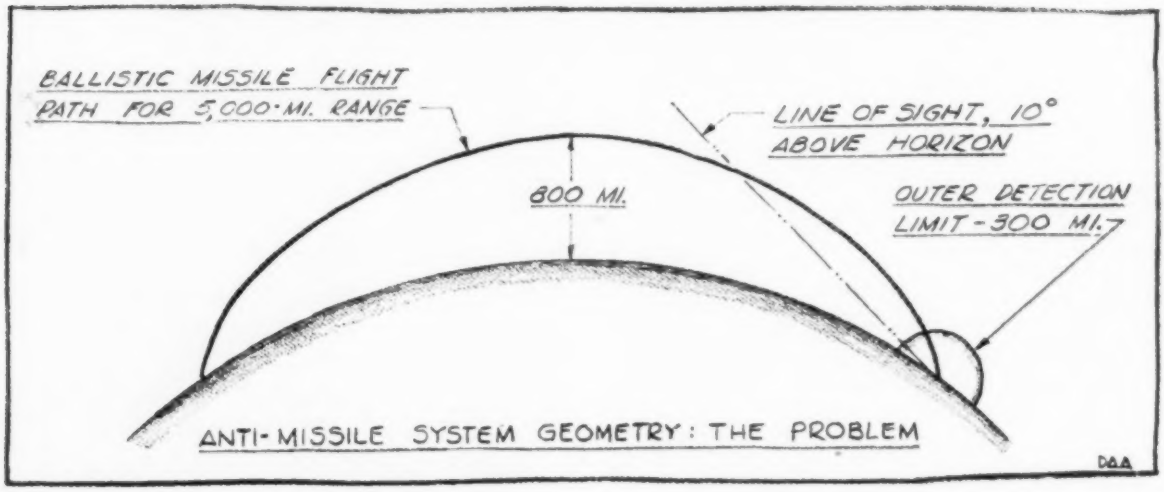
BALLISTIC MISSILE FLIGHT PATH FOR 5,000-MI. RANGE
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800 MI.
OUTER DETECTION LIMIT - 300 MI.
ANTI-MISSILE SYSTEM GEOMETRY: THE PROBLEM
DAA

Effective ICBM Defense Possible Under

By David A. Anderton

An effective defense against the intercontinental ballistic missile is within the reach or close extrapolation of current techniques in aerodynamics, avionics, propulsion and structure.

Answers to the questions still blocking the way already are being sought in this country's latest weapons-development phase. Once they are found, there should emerge an anti-missile missile system that could become the classical defensive antidote to the offensive might of the ICBM.

A major contributing factor to the urgency of the four projects now active in this field has been the knowledge that the Russians are firing an intermediate-range ballistic missile with some form of guidance over distances approaching 1,000 mi. These firings have been made often enough during the past six months to show that the missile is in an advanced development phase.

The four U.S. anti-missile projects—at Bell Telephone and Cornell Aeronautical Laboratories for Army Ordnance, and at Convair and North American for the Air Force—have a common goal. They must intercept and destroy enemy ballistic missiles—either medium or long-range—far enough from their intended targets to protect those areas from the primary effects of a nuclear blast and the secondary effects of radiation and fallout.

Ten years ago, interception of a ballistic missile in the V-2 category was considered impossible, prohibited by the limited state of the missile art. Now, engineering optimism about some of the problems to be faced indicates that defense against future ICBMs is feasible at least.

The basic problem of the anti-missile weapon system—now called "antis" (pronounced "aunties") in scientific slang—is to detect, identify, intercept and destroy an incoming enemy missile. That problem might look like this:

'Antis' in Action

Fifteen minutes ago and 5,000 miles away, a towering rocket roared upward in the brightness of an Arctic afternoon. Now almost motionless in space, it coasts over the top of its elliptical trajectory, 800 miles up, and begins its long fall back toward earth.

Minutes later, still dropping tail first, it crosses the invisible boundary on the outer limit of radar detection about 300 miles from the target area. The radars come alive; they track the tiny target whose signal strength increases rapidly and ominously. In a few seconds, a tentative trajectory is computed from the tracking data, and two sets of data are transmitted.

The first set selects the anti-missile batteries, alerts them and feeds them the first computed flight paths and intercept coordinates.

The second set feeds the probable coordinates of the enemy firing site to a distant battery where an ICBM is standing by for retaliation.

The radars continue to track, and the computers continue to correct flight path and intercept data, feeding it out over the communications network to the anti-missile batteries. They wait for the firing signal while the enemy missile hurtles toward the target, ticking off three miles every second.

At the last possible second, the firing signal flicks out from the central computers. The white light of the rocket motors firing lights up the launching pads to show glimpses of slim shapes leaping upward to intercept and destroy their targets.

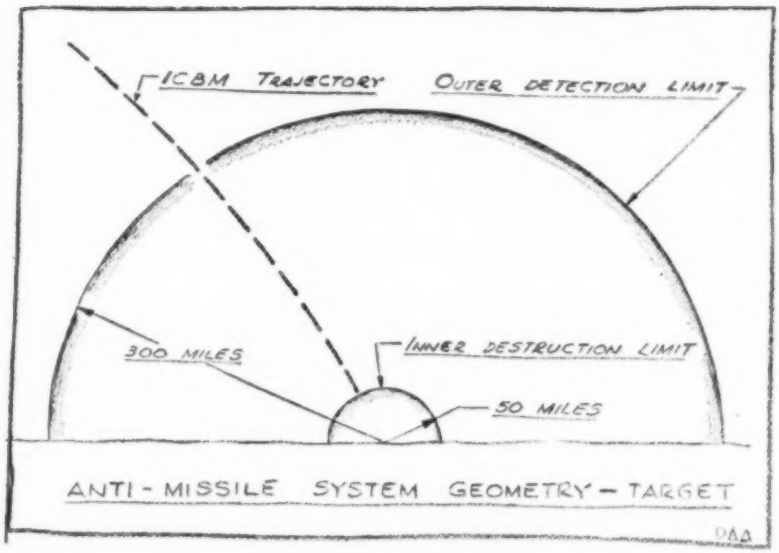
Studies of defensive systems like these began with the start of the German V-2 offensive against the port cities of London, Antwerp and Calais. These early approaches to the problem—among them General Electric's Project Thumper (MX-795)—concluded that defense against even as elementary a weapon as the V-2 was technically beyond reach. The only solution was to stop the rocket before it ever got off the ground.

Why the 'Anti' Lag

The V-2 approached Mach 5 in its downward dive to the target. Each second it fell 5,000 ft. nearer the ground. From launch to target, the V-2 was in the air about five minutes; its peak altitude was about 60 mi. at a point about halfway—or 75 mi. to 100 mi.—to the target.

The task of acquiring the V-2 by radar, identifying it and plotting its trajectory in order to predict a collision course for the interception left very little time for the anti-missile missile to be launched and approach its target.

Calculations showed that generally an



Present State of Art

anti would require a flight speed about twice that of the V-2—or about Mach 10—in order to meet the time limitations of the problem. Those kinds of speeds were not available at all in 1945 and later.

But speeds of that order are completely feasible now; available to a defensive weapon, they are also available to the offensive. The target for the antis no longer lopes along at five times the speed of sound, but will be hurtling downward at Mach 10 or 15.

Paradoxical Problem

There is a strange paradox in the advanced state of the art that is now capable of developing an intercontinental ballistic missile: The task of defense against the ICBM has been made easier. The anti-missile system has more time to do its job.

An ICBM will have a flight time approaching half an hour. It comes in towards its target from such a height above the earth that there is no effective radar blanking by ground effects, within the useful range of that radar.

The use of conventional radars, which would determine missile flight path and speed by tracking the tiny target, seems like a logical approach to the detection problem.

One recent clue to the possible detection range is in a statement made recently by a British official, who said that British scientists had a radar capable of picking up an oncoming missile 300 mi. distant from the target. Conventional tracking radars would give slant range to the missile on a time basis; that data could be reworked to plot an accurate flight path within a matter of seconds after the first faint echo on the scopes.

A relatively new radar technique was developed for tracking enemy mortar shells during the Korean war, not for defense, but to spot the locations of the enemy batteries. The MPQ-10 mortar-locating radar developed by the Sperry Gyroscope Co. tracked the shell in flight, and calculated its trajectory back down to the firing point. The coordinates then found were the basis for an air or artillery strike.

Later experimental use has been made of that radar in tracking short-range missiles, presumably the Army Corporal or Redstone. During these trials, the MPQ-10 tracked the missile after takeoff to predict its impact point as an aid to the downrange tracking crews and in the spotting of the impact area.

Tracking of hypersonic missiles may be simplified because of an inherent characteristic of flight at high supersonic speeds.

The intense heat generated by skin friction causes dissociation of the gases in the atmosphere and creates a shroud of ionized particles around the missile. This would give a stronger reflection of the radar beam and aid tracking. However, it would not be present until there was enough air to be ionized, which would occur only at altitudes considerably below the peak of the trajectory.

Two factors conspire to make the plotting of trajectories difficult:

• **Manufacturing tolerances and small-scale disturbances** in the atmosphere cause scatter—a deviation from the theoretical elliptical path, already modified to some known extent by air drag.

• **Planned deviations from course,** programmed into the missile flight path before takeoff, may further distort the trajectory.

For the first, the actual deviation from the flight path is small, because the flight path is of such short duration in the atmosphere that a large deviation simply does not have time to happen.

For a similar reason, the programmed deviation is apt to be small and may in fact be ignored in the strategic use of these missiles because of the small return on the enormous technical effort required to change a trajectory once the missile is speeding on its way.

How High the Boom?

Power of the ICBM warhead plays a governing part in the design of an anti-missile system. Many of the V-2 rockets detonated prematurely from a few thousand to many thousands of feet above the ground. In all cases, damage at the target area was minor.

But an ICBM with a thermonuclear warhead would be almost as destructive if it were detonated at considerable heights above the target. An effective radius of 20 mi., mentioned in connection with the thermonuclear warhead, is applicable to altitude as well as at ground level.

For this reason, the absolute minimum altitude or slant range at which the oncoming missile must be destroyed will be determined by the expected enemy choice of warhead. On top of this, a safety factor must be added.

Final radius of the defensive hemisphere covering the target would have to be the sum of the effective range of the warhead plus the safety factor. Expected radius would then be on the order of 50 mi. as a minimum.

Some Numbers

Establishing an inner limit for destruction of the enemy missile and an outer limit for its detection means that some first approximations can be made of the performance required of the defensive system.

The assumed enemy ICBM has these characteristics: Range, 5,000 mi.; flight time, 30 min.; peak altitude, 800 mi.; velocity at burnout, 22,000 fps.

Two hemispheres define the inner and outer limits of the target area: The outer detection limit has a 300-mi. radius, and the inner destruction limit has a 50-mi. radius.

First step is to calculate flight times for an anti-missile missile, assuming ground level launchings and a range of possible average accelerations. For a 5G missile, flight time from ground to 50 mi. limit is about one minute; quadrupling the acceleration to 20G reduces the flight time by half to about 30 sec.

The missile coming toward the target

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at Mach 20 is traveling at a speed of approximately four miles per second. To make the interception at the 50-mi. marker, the anti-missile must be fired when the enemy missile reaches a distance equal to the 50-mi. limit plus the distance to be covered by the enemy missile during the anti-missile flight time.

For the case of the Mach 20 enemy missile, this is simply the sum of 50 mi. plus four times the anti-missile flight time.

For a 5G anti-missile system, the distance works out to about 274 mi.; for the 20G system, the firing point is when the enemy missile is 166 mi. out.

Time margin for detecting, tracking, plotting and actuating the interception can be calculated for the various systems.

It is the time required for the enemy missile to travel from the 300-mi. detection limit to the point at which the anti-missile must be fired to guarantee an interception outside the 50-mi. danger zone.

For a 5G system, that time margin is only six or seven seconds, but for the 20G anti, the time increases to better than half a minute, a margin that seems more than adequate for the task.

General Impression

This skeleton definition of the problem and the approach to its solution can only hint at the kind of missile defense system needed to do the staggering task of knocking down the ICBM. But even from this basic consideration of the problem, it is possible to rough out the lines of a system to do the job.

Most apparent feature of such a system is that the hardware—the anti itself and its attendant gear—is the least part of the job. The radar detection, communication and computer networks are the heart and brains of the system, and will require the greatest effort.

The overall system would be comparable to tying in the Canadian early-warning lines with all the Nike anti-aircraft missile sites, using the communications networks established by commercial telephone, radio and television operators in a "super-SAGE" system.

The missiles themselves would require enormous thrust-weight ratios because of the high average accelerations. Their warheads would be probably of the tactical nuclear variety, small enough to fit a package about one foot in diameter. Battery fire would be used against an ICBM, because it would not be possible to gamble on the kill probability and reliability of a single missile.

Similar approaches would be used to defend against the enemy IRBM; the time limits would be a little tighter because of the shorter flight time of the medium-range missile. This would be partially compensated by the lower velocity of the missile on its final plunge to the target; such speeds would be probably under Mach 10, instead of double that figure.

The most interesting point about these numerical approximations is that they define the limits of the problem independently of the specific systems required to do the job. But further than this, these numbers show that present-day capabilities of techniques used in missiles, radars and computers would not have to be stretched too far to accomplish the anti-missile job.

This is not to say that it is an easy job or one that could be done with existing equipment.

But these numbers indicate that interception and destruction of either an ICBM or an IRBM is feasible based on the current state of the art.

Denver Missile Site

Artist's drawing shows proposed layout for Martin's new Denver Division where the company will conduct its research-and-development programs for guided missiles. Facilities include 610-by-244-ft. main factory (in background) and two-story engineering and administration building, foreground. One-story cafeteria connects the two buildings.

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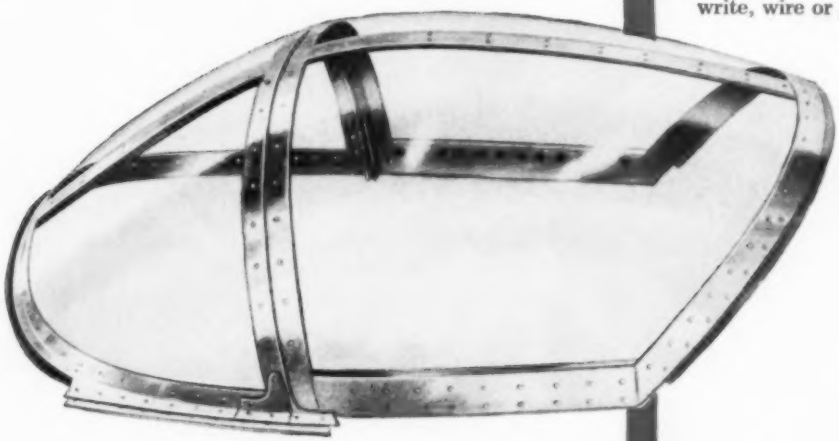

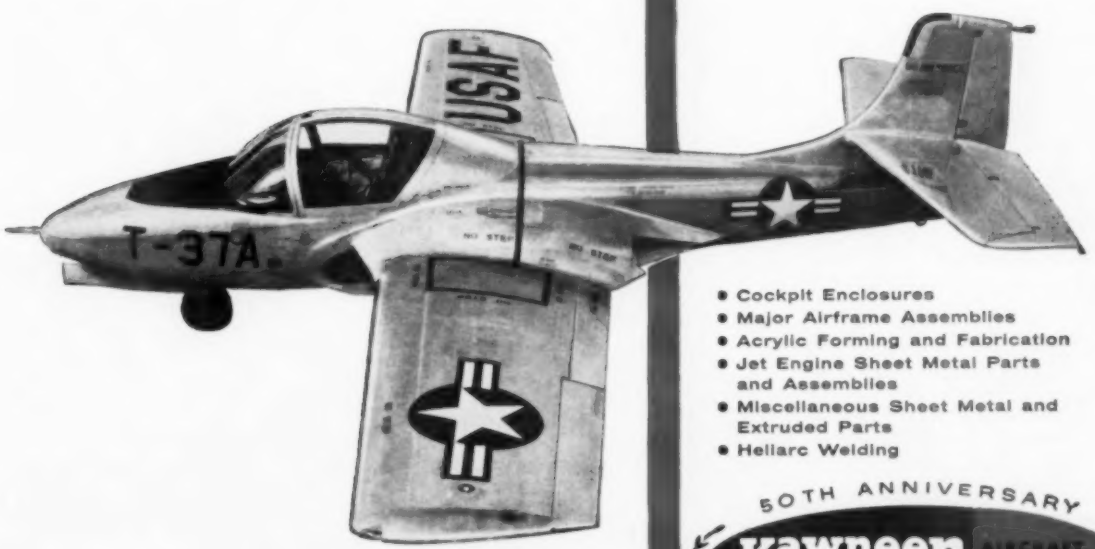

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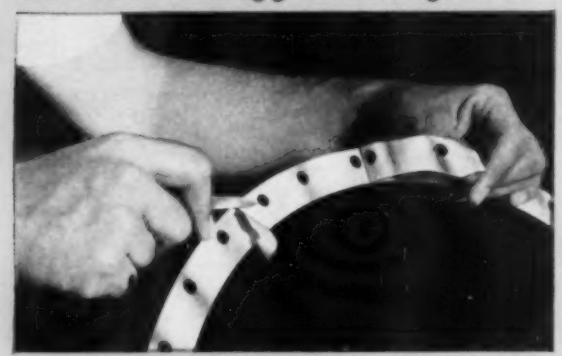
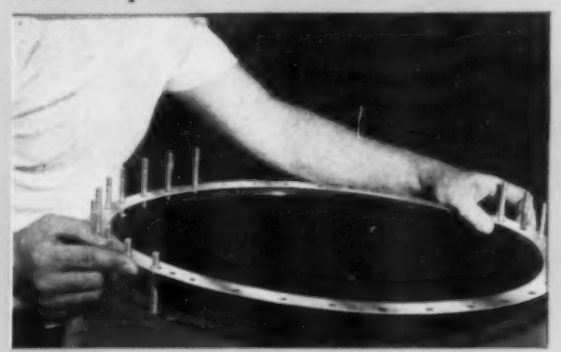


"Laminum Shims simply p-e-e-l for adjustment. The fact that layers come in standard sizes makes our job easier and quicker."



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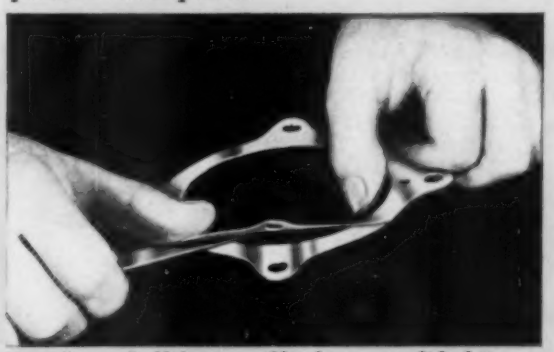

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MIT Probes 'Miles-Per-Gallon' Problem

By Robert H. Cushman

Two answers to the important problem of getting the most miles out of each pound of fuel carried by jet aircraft are being sought by the Massachusetts Institute of Technology's Instrumentation Laboratory.

The first, called an "optimalizing" system, automatically tailors itself in flight to get the most miles per gallon from the particular engine-airframe it is monitoring. It does this by sensing the correct speed for maximum range and maintaining the throttle near the corresponding setting. It will not be available, however, for another two years.

The second system—which is semi-automatic—should be on the market sooner. It presents a group of three easy-to-read instruments which show the pilot how he should fly to achieve maximum range.

Optimalizing System

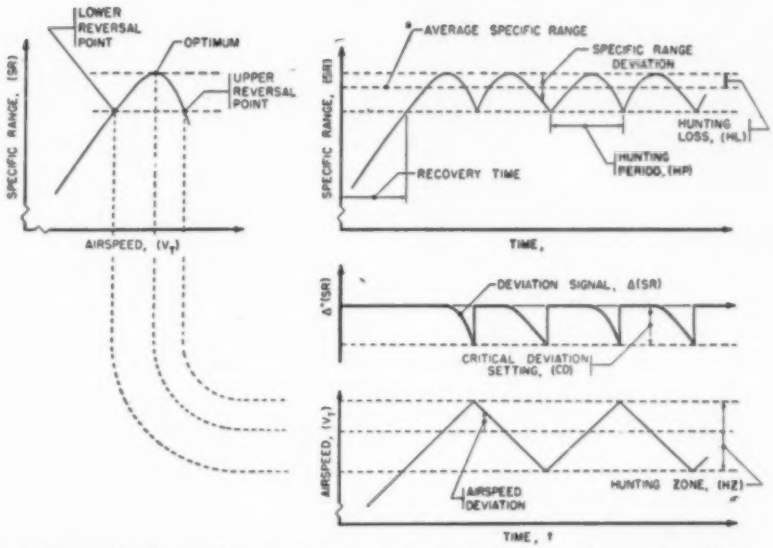
Optimalizing, originated by C. S. Draper and Y. T. Li of MIT, offers the following advantages:

- **Tighter control loop.** The new system is constantly feeding back information, servo-fashion, on its own behavior. It is, in effect, recalibrating itself in flight to make best use of its present condition. If the airplane drag suddenly went up due to battle damage or dropped because an external fuel store was jettisoned, the new method would account for this change. At present such control decisions are based on data gained from idealized aircraft model tests and test cell runs.
- **Freedom for pilot.** Since the pilot is relieved of awkward fumbling with the flight data manual he can spend more time on overall mission-planning.
- **Independence from accuracy** of aircraft instruments. The system is more concerned with relative than specific values.

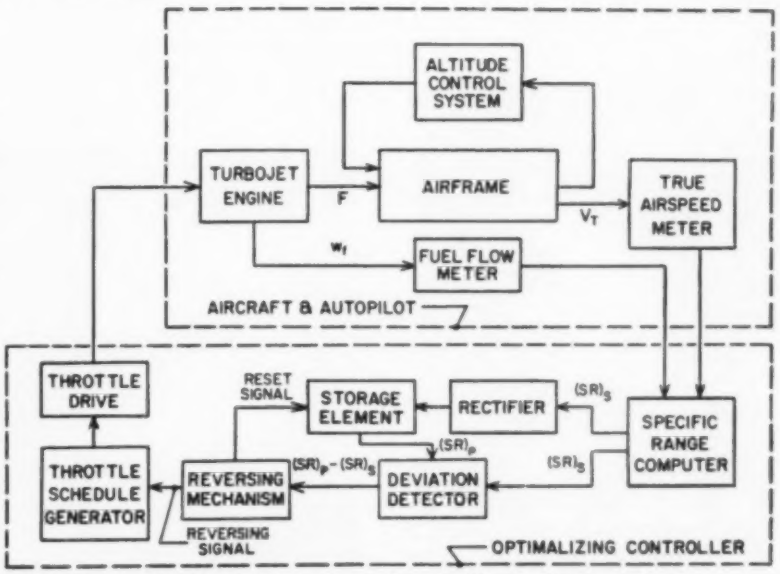
Mach-Limited Aircraft

Optimalizing and the semi-automatic system will be applicable to contemporary fighters and future bombers which, though they have enough thrust to spurt into transonic and even supersonic speeds, must stay below the transonic drag-rise for efficient cruise.

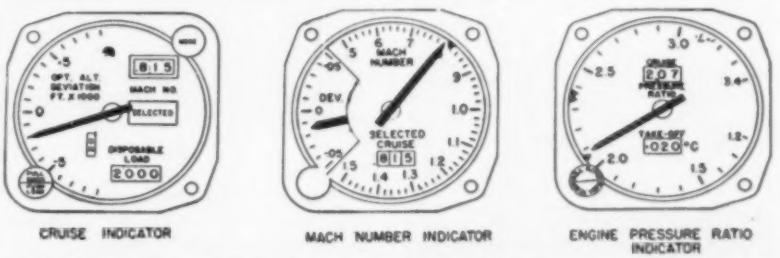
The systems, however, do not apply to older-type fighters and present bombers which are "thrust-limited" or do not have enough engine power to come near the drag rise in level flight.



PERFORMANCE CURVE for optimalizing cruise system using airspeed as controlled input.

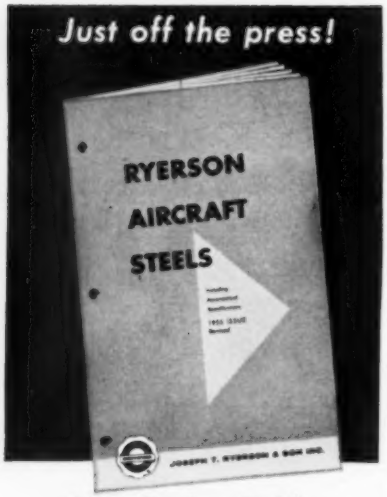


FUNCTIONAL BLOCK DIAGRAM of typical optimalizing cruise control system.



CRUISE INDICATOR — MACH NUMBER INDICATOR — ENGINE PRESSURE RATIO INDICATOR

SEMI-AUTOMATIC SYSTEMS' display utilizes group of three, easy-to-read instruments.



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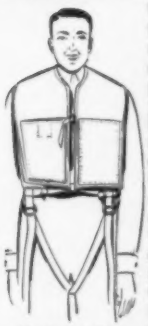

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Nor do they apply to truly supersonic future fighters which will be able to cruise beyond the drag hump.

As optimalizing is automatic, it could be used to extend the range of transonic pilotless bombers and missiles like the Snark, Regulus and Matador

How It Works

What this system does is shown by the history of flight speed and specific-range chart on page 51. How it works is indicated by the block diagram on page 51.

With the system engaged, flight speed bounces between two limits—each of which is relative to the variations of the specific range. The airspeed variations come from the throttle being slowly and continuously driven by a small motor. Meanwhile the system control elements digest information fed back from the aircraft airspeed and fuel flow instruments and automatically reverse the throttle direction whenever the amount of "miles-per-gallon" the aircraft is getting falls too far below the currently best value.

Thus the throttle continually nulls about the instantaneous position for maximum range. The optimalizing controller takes true airspeed and fuel flow from the aircraft and sends back throttle position. The specific range computer (an electronic analog type) uses Ohm's law to divide the electrical (voltage) signal from the airspeed indicator by the electrical (current) signal of the fuel flow meter to arrive at the specific range (resistance). The specific range comes out as a mechanical signal because a motor-driven balancing potentiometer is used.

The specific range (SR) goes up until the best speed is reached and ther falls off as the throttle is driven beyond.

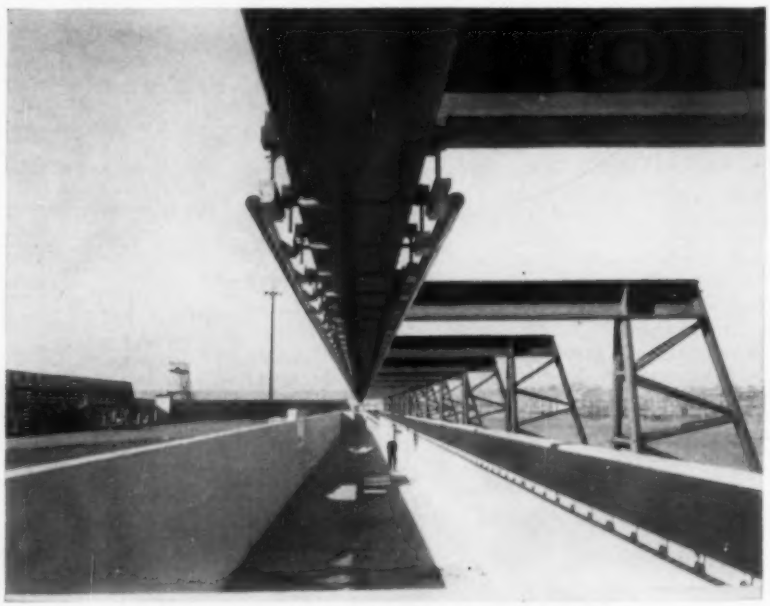
While the airspeed is approaching the best value a rachet (rectifier) cranks up the maximum value of specific range. Once the airspeed goes past optimum, the rachet holds the highest value received.

The deviation detector notes the growing difference between the stored value and the falling value of specific range as the airspeed overshoots.

When a preset lower limit for the specific range is reached, a catch in the reversing mechanism reverses the throttle direction and resets the rachet so that the cycle can start afresh. So far as the optimalizer controller is concerned it doesn't matter whether the airspeed is going up or down; it only cares if the specific range is changing.

Productive Hunting

Thus at the cost of some artificially imposed airspeed hunting, the airplane gets to "know itself." In a Mach-limited aircraft, the engine is overpowered for its airframe; the engine would like to put out more thrust for better specific fuel consumption, but the drag-rise penalty that the airframe would pay with such additional thrust more than offsets the engine's gain. The optimalizer system automatically finds and maintains



Convair Tow Basin for Models

First model seaplane towing basin on West Coast, this 300-ft-long tank is being completed at Convair's San Diego Division. Installation will be used for hydrodynamic research and development of jet and turboprop seaplanes. The unit is part of a proposed hydrodynamics laboratory which will include two towing tanks, turning basin and office structure.

the speed at which these two factors best compromise.

MIT says hunting or speed deviation can be held as low as 10-20 knots 10-minute cycles. The specific range loss due to the hunting oscillations is expected to be less than 1%.

Because a 10-knot speed variation was found to give the same percentage cut in range as a 1,500-2,000 ft. altitude variation, MIT felt that it would be better to optimalize speed while allowing the aircraft autopilot to hold altitude.

Ford Instrument Co. is working on a practical application of this system for the Navy. No completion date has been set.

The second system under development by MIT can either be considered a simplified alternate or a complementary system to be used with the optimalizing system.

It is not as direct or automatic as the optimalizing system, but the engineers at MIT feel it is a more immediate solution to the pressing problem of cruise control.

This system presents a display in front of the pilot upon which he can base his cruise control decisions.

The pilot selects the highest Mach number which holds his aircraft below its drag-rise point of diminishing returns, sets it in the left hand instrument, flies to the indicated altitude, and then trims ship and throttles back until the other two instruments match their correct readings.

Li estimated that the system will be commercially available in two years. The Avionics Division of John Oster Co., Racine, Wisc., is building the prototype and extensive flight tests have been planned with the Air Force for the coming summer, but it will undoubtedly take another year before final design packaging and production can start.

A number of changes have been made in developing the practical aspects of the principle, according to N. Zelazo, head of the Oster division. In an effort to further ease the pilot's task in the control loop, some of the manual input knobs have been eliminated and specially lighted vertical readers have been substituted for the conventional dials.

Also in the works at MIT is a continuous display which indicates to the pilot how much range he has left.

Besides Li and Draper, engineers associated with the projects are W. B. Bryant and H. L. Pastan on the optimalizing system, and M. A. Hoffman and J. A. Navoy on the semi-automatic system. A paper on their progress was given at a recent meeting of The Institute of The Aeronautical Sciences.

The cruise control investigation is being sponsored by the Wright Air Development Center's Flight Control Laboratory under direction of Guy Lai.

(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.

Ever tried to skewer a six-engine Boeing Stratojet on the nozzle of a refueling boom at 15,000 feet and better than 300 m.p.h.?

It's a real experience.

The Strategic Air Command let me try it over Southern California recently as the prelude to riding through a seven and a half hour bomber stream mission with the 320 Bombardment Wing out of March AFB, headquarters of the 15th Air Force.

I use the word "try" advisedly, for that's all I did. It wasn't even a good try, actually, for nosing the sweptwing medium into the tiny envelope of space required for a refueling connection is a fine art, believe me!

Riding fourth position in a B-47 means you ride on the deck, sans ejection seat, and struggle out of your own parachute and into that of the pilot when he changes seats (and 'chutes) with you in the crowded cockpit area.

In actual refueling operations, the aircraft commander in the front seat flies the ship while the pilot in the rear seat handles the valves that control flow to the various tanks.

During my flight with the 441st Bomb Squadron, Major Dan Henshaw, aircraft commander, and 1st Lt. Tom Schaefer, pilot, took aboard some 10,000 pounds of JP4 in an operation that looked as easy as the proverbial pie, with the boom telescoping only a foot or so and swaying even less.

Then Henshaw asked me to follow through on the controls in a dry run, and I felt the quick, slight stick movements as he nudged the bomber slowly but surely into position, so neatly that the boom operator in the big KC-97 tanker guided the nozzle hardly an inch to target the slipway dead-center.

It still looked easy.

When my turn came, the Major lined the Stratojet up perfectly some 200 yards aft of the tanker and told me to take her in. He, of course, had the safety factor of six jet throttles in his hand.

For perhaps five seconds everything went fine as I closed. The nose moved forward slowly toward the extended 41-foot flying boom and I could see the tanker's four big props thrashing the air up ahead.

Then I slewed off to the right just a bit and corrected immediately. Trouble was, I over-corrected and swung even farther to the left. The next correction naturally piled me even farther off target . . . and the next still farther . . . until I felt like a pendulum making a movie-type World War I fighter approach.

The Major was kind as he chopped the throttles.

"You haven't quite got the feel of her yet – try again."

I tried, but it was still no go with that sensitive bird. Maybe a little better, but still a long way from contact. Taut and sweating, I relinquished the controls.

The ensuing radar bombing mission, with 22 Stratojets chasing us at 10-minute intervals across 3558 miles of the Western United States was a revelation, despite all I had heard of SAC precision.

We hit five cities with imaginary hydrogen bombs. Two of the penetrations were camera attacks with the lense focused on the radar scope for later evaluation. Three were scored by Radar Bomb Plot and counted on the crew's record, particularly that of Major Claude Hobson, our observer.

This was a select crew, top-rated in SAC, and they showed it in their meticulous attention to detail, in constant, untiring alertness; in their complete imperturbability and split-second cooperation as the big ship (with more than 50 Whittaker valves cycling in her systems) bored through the fringe of the stratosphere at just under 500 m.p.h. through daylight and a brilliant sunset and on into the soft velvet of night.

From a 10-second countdown to brake release precisely at take-off time to the tortured "scurtch" of the tires on landing, the long mission was flown exactly as ordered across 22 check points on the complicated flight plan with its mandatory speeds, times, altitudes and compass headings.

SAC demands precision from its crews, and skill and courage. These the command gets, and more—determination and an indefinable pride in accomplishment that guarantees these men . . . when called on . . . will be in the right segment of space at the right time with the right bomb!

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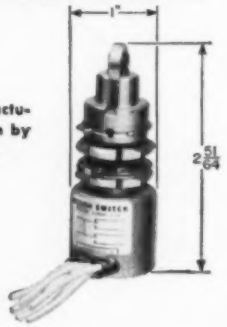
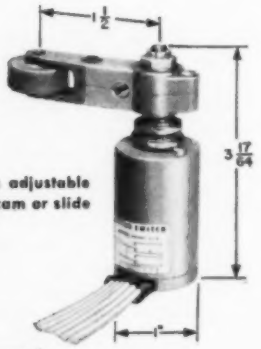
In the long MICRO SWITCH line are many other switches and assemblies which have contributed to aircraft design. Among them are many varieties of rotary-actuated switches, door interlocks, heavy duty and high capacity switches. All may be supplied with actuators and circuitry designs to meet specific requirements.

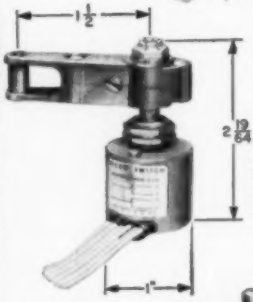
New sealed cylindrical switches provide unusual design flexibility



Roller plunger actuator for actuation by cams and slides.



Spring return adjustable actuator for cam or slide actuation.



Positive drive adjustable actuator for linkage operation.

Plunger actuator for in-line motion operation.

For complete information on these and on the complete line of aviation switches contact the MICRO SWITCH *branch office near you.*

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French Point Rocket Plane to Mach 1.6

The Sncaso 9050 Trident, which has reached supersonic speeds in a climb, is in a development program aimed at proving the designers' claims for a level flight speed of Mach 1.6.

Trident's straight-winged layout contrasts sharply with France's other interceptor project, the delta-winged Dassault 550. Mission for both these planes is to attack supersonic bombers flying at high altitudes. The major design requirement is a built-in high rate of climb, coupled with high-altitude maneuverability.

Sncaso engineers chose a rocket powerplant as the prime mover (augmented by a pair of turbojets for the lower-speed end of the performance range). Integration of the two types of engine with the aerodynamic systems needed to combine climb and maneuverability gave the Sncaso designers the unusual Trident layout: short-span, straight wings with tip-mounted turbojets and a set of slab tail surfaces that control the airplane about all three axes.

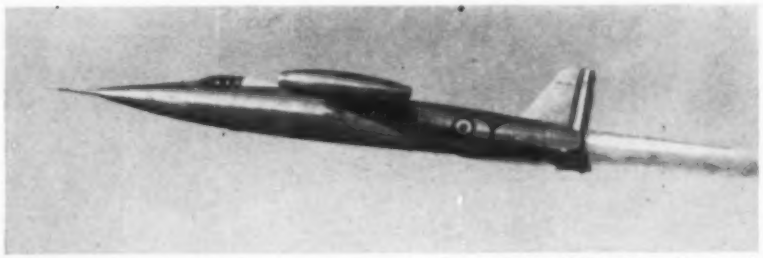
The mixed engine formula, also followed by Dassault in the 550, is the best compromise between the short-range pure-rocket aircraft and the longer-range, lower-performance pure-turbojet layout.

Rocket engine of Trident is a three-cylinder SEPR 25 engine, developing 3,310 lb. thrust per cylinder for a total of 9,930 lb. thrust. The rockets burn a hypergolic (self-igniting) mixture of furaline and nitric acid. Each thrust cylinder can be operated separately or in combination with any other.

Turbojet engines on the prototype are a pair of Armstrong-Siddeley Vipers, built in France under license by Dassault. These engines, designated MD 30, develop 1,650 lb. thrust each. Developed versions of Trident will probably use more thrust; Turbomeca Gabizo engines have been suggested as one possibility.

The short-span wing is relatively thick – approximately 8% thickness-chord ratio. It mounts plain flaps on the lower surface. The prototype shows surfaces like ailerons where ailerons should be, although Sncaso says that lateral control is handled by differential operation of the slab tail surfaces, operated by irreversible servos. Two alternatives are possible: Either the ailerons were originally there as a precaution and later found unnecessary, or they are simply "feelerons" to give the pilot some feedback stick force.

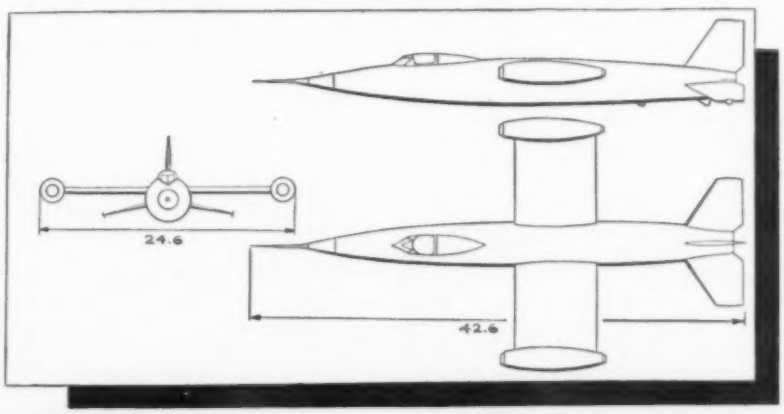
Honeycomb structure was used extensively in Trident, and the French firm says the plane's empty weight is about one-third that of "conventional interceptors."



TRIDENT blasts through air on power from its three-cylinder SEPR 25 rocket engine.

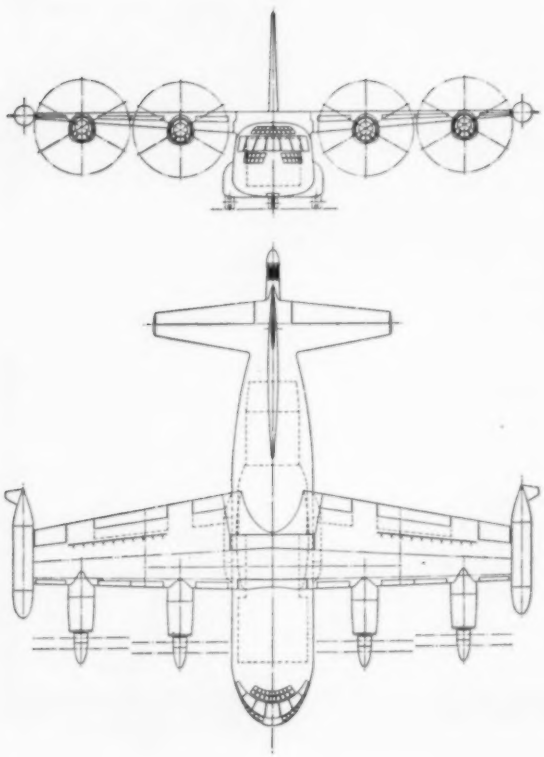
WING-TIP TURBOJETS each develop 1,650 lbs. thrust to augment power of rocket engine

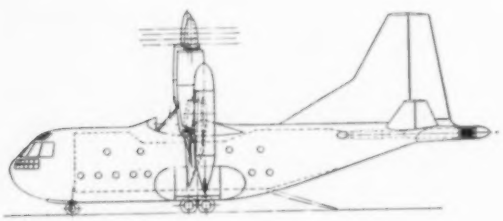
TRIDENT is slipped over pit for maintenance check. Note rocket engine's three cylinders.

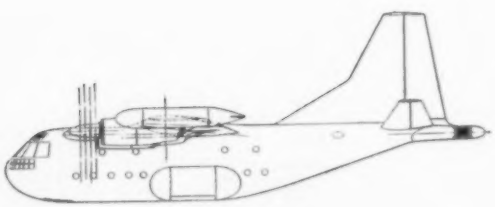


THREE VIEW of Sncaso's Trident interceptor points up aircraft's straing-wing geometry.

FOUR-ENGINED HILLER would be able to operate out of small clearings as military transport (above). Louvered tail-jet provides pitch and yaw control while the aircraft is hovering.







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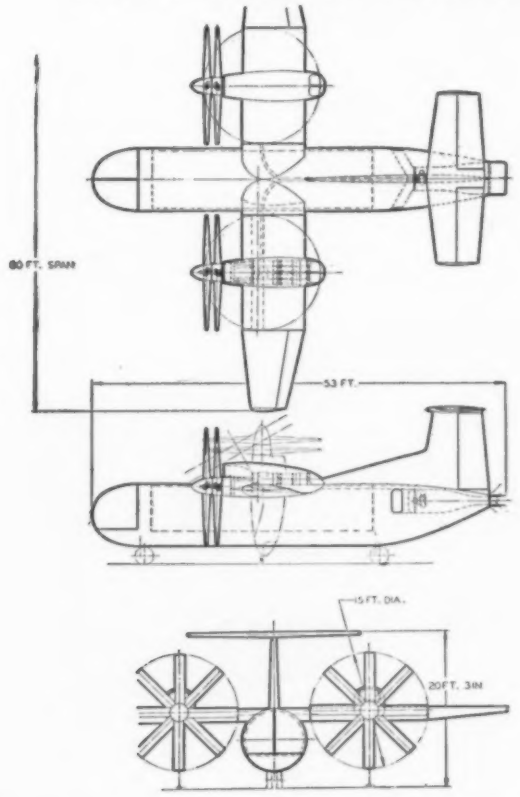
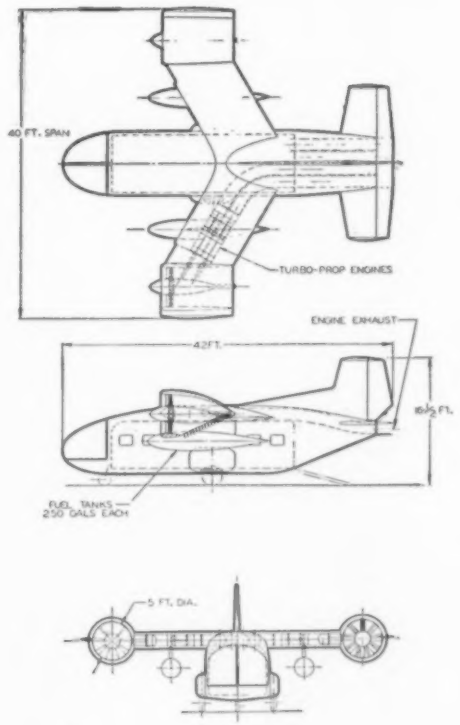


DUCTED PROPELLER VTOL AIRCRAFT DESIGN STUDY



BEFORE DECIDING upon a definite design, Hiller studied the advantages of the tilt-wing type against those of the ducted propeller.

Hiller Puts VTOL Hopes on Tilting Wing

Hiller Helicopter is placing it hopes on the propeller-lifted, tilting-wing VTOL concept in the industry race to produce a practical vertical-rising transport design.

Hiller's chief technical engineer, Joseph Stuart 3d, says the principal advantage of the tilting wing is that it reduces thrust requirements during transition from vertical to horizontal flight. Theoretical studies, Stuart says, and NACA free-flight model tests both indicate that the lift generated by the wing at all air speeds as its angle of attack decreases from 90 degrees causes the decrease in thrust requirements.

When the vertical component of propeller thrust has to produce the necessary lift unaided, thrust requirements are found to rise sharply during the first part of the transition.

Pitch and Yaw Control

Pitch and yaw control are provided in the Hiller design by controllable tail jets. Propeller wash is expected to carry away tail jet exhaust gases and prevent them from being recirculated through engine intakes. Roll control while hovering is provided by differential control of the power settings of the wing-mounted engines.

Linkage using helicopter swash plates may be designed to wash out the differential power control and restore normal aileron control as the wing approaches normal angles of attack.

Propeller-Lift Advantages

The wing pivots which must bear the entire weight of the aircraft are not expected to create any particularly difficult engineering problem, Stuart said. He reported that the loads carried by the wing pivots are actually much lower than those carried by the main propeller blade retention bearings.

Stuart said the propeller lifting system was chosen because:

- **It offers the lowest powerplant plus** fuel weight for hovering flight durations in the very useful three to 10 minute range and is only slightly inferior to rotor systems for hovering durations up to a half hour.
- **Propellers are estimated to be lighter** than rotors in spite of the additional weight of pitch and yaw control tail jets needed by the propeller system for control in hovering flight at a design weight of 60,000 lb.
- **Well-developed production and** maintenance techniques reduce the possibility of unforeseen production and maintenance problems.
- **Low noise levels can be assured** through the use of relatively low propeller tip speeds.
- **Overload takeoffs and landings can** be made in conventional airplane configuration with a high wing and fuselage-mounted gear.

Stuart said that each of the four dual rotation propellers in the Hiller design is driven by at least two turbine engine power sections. The failure of one power section, therefore, cannot make the airplane uncontrollable during hovering flight.

Hiller studies and tests of propeller stresses at the thrust level anticipated indicate that vibratory thrust levels will be acceptably low.

Stuart pointed out that a propeller-

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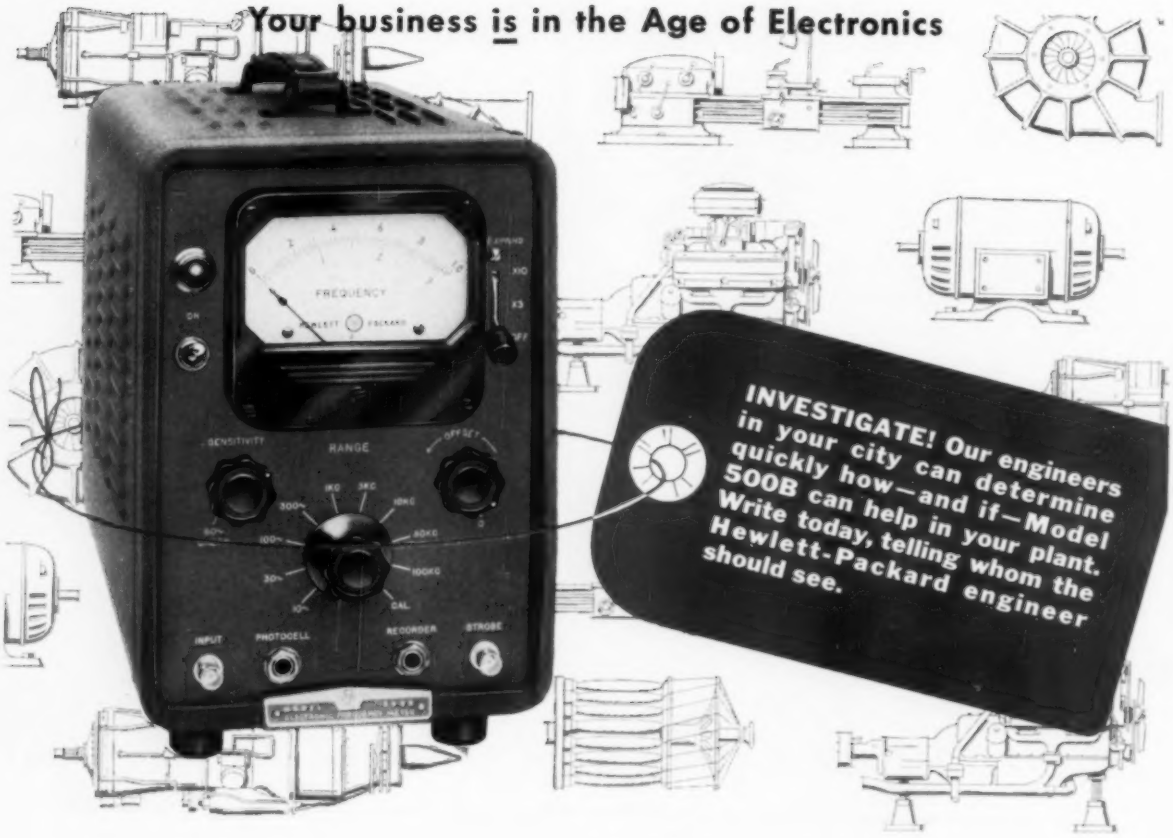

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lifted tilting wing transport could be developed immediately using existing gas turbine engines and propellers while other VTOL concepts require extensive powerplant development.

Stuart said that other vertical lift generating systems considered by Hiller included:

- **Direct lifting turbojet or ducted fan** engines.
- **Ducted propellers powered by turbine** engines.
- **Lifting rotors designed to be idled,** stopped, retracted or used as propellers in forward flight.

At the gross weight of 60,000 lb. used in the study, direct-lifting turbojets were found to generate the necessary lift with the lowest powerplant-plus-fuel weight for hovering flight durations up to three minutes.

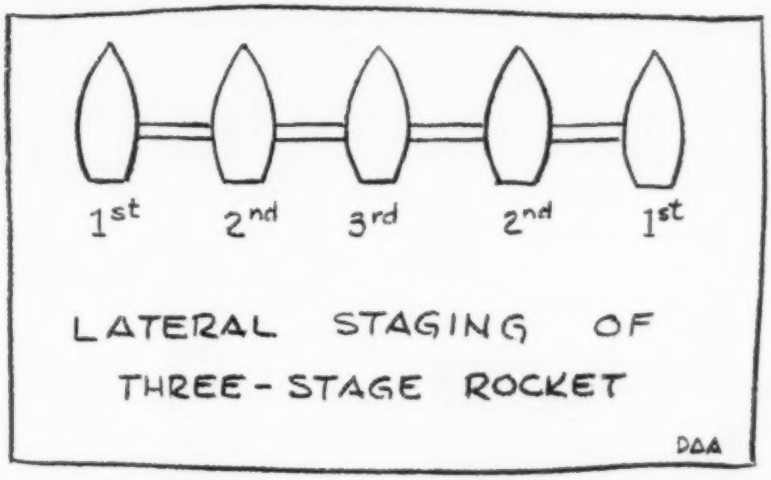
They were rejected, however, because the high turbojet specific fuel consumption caused weight disadvantage which increased rapidly with time for hovering durations greater than three minutes.

A turbine-driven, ducted propeller lifting system was rejected because duct weight, and duct and turning vane drags at high speeds, were found to be too great.

Rotor lifting systems, while generating the most lift per brake horsepower, run into difficulty because:

- **The numerous mechanical** articulations in a rotor hub create a maintenance problem.
- **Rotor blades are difficult to tool,** fabricate and handle in the field and their critical cemented joints are difficult to control and inspect.
- **Large, slow turning rotors are the** source of uncomfortable, difficult to isolate, low frequency vibrations.

Hiller has also been engaged in a retractable rotor system study for the Air Force.



Lateral Staging Plan Proposed for Rockets

A different approach to the design of a multi-stage rocket such as an ICBM or an earth satellite has been investigated by two Glenn L. Martin Co. engineers, Dandridge M. Cole and L. Ivan Epstein.

Martin has contracts for both an ICBM (Project Titan) and an earth satellite (Project Vanguard).

The new scheme would use lateral staging, with parallel burning of all stages simultaneously, rather than the tandem-staging, series-burning procedure conventionally associated with multi-stage rockets.

Cole and Epstein evaluate similar tandem and lateral configurations using a performance criterion developed earlier by Melina and Summerfield for multi-stage rockets. They say all cases investigated show higher performance with lateral staging than with tandem.

All rocket motors burn simultaneously in the lateral arrangement. During the burning period, fuel is pumped from the outboard tanks to the inner rockets at a rate that keeps all tanks except the outer ones full of fuel. When fuel is exhausted from the outer units, they are jettisoned.

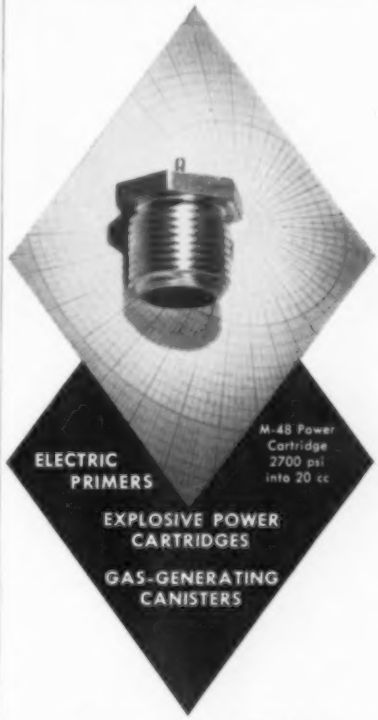
This continues until only the center single rocket is left.

Comparison of the two systems was made on the basis that both multi-stage rockets would have the same payload, structural weight and propellant weight. All the motors of the lateral scheme would be identical with the final-stage motor of the tandem rocket.

Other advantages of the unusual layout cited include a higher thrust-weight ratio, and ignition of all motors before launching.

Cole and Epstein presented their findings in the Journal of the American Rocket Society.

SQUIB SPECIALISTS



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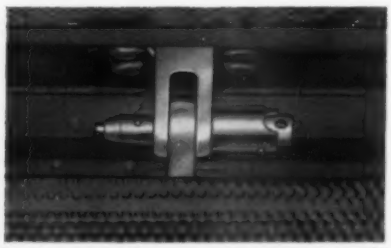

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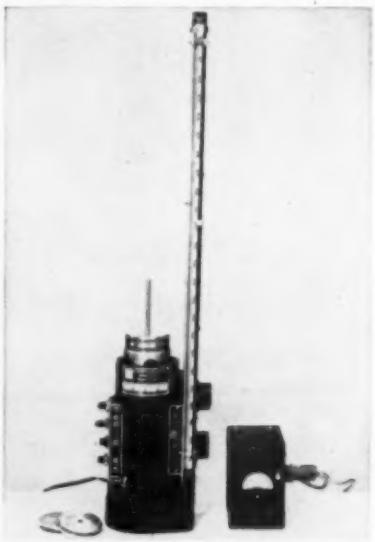


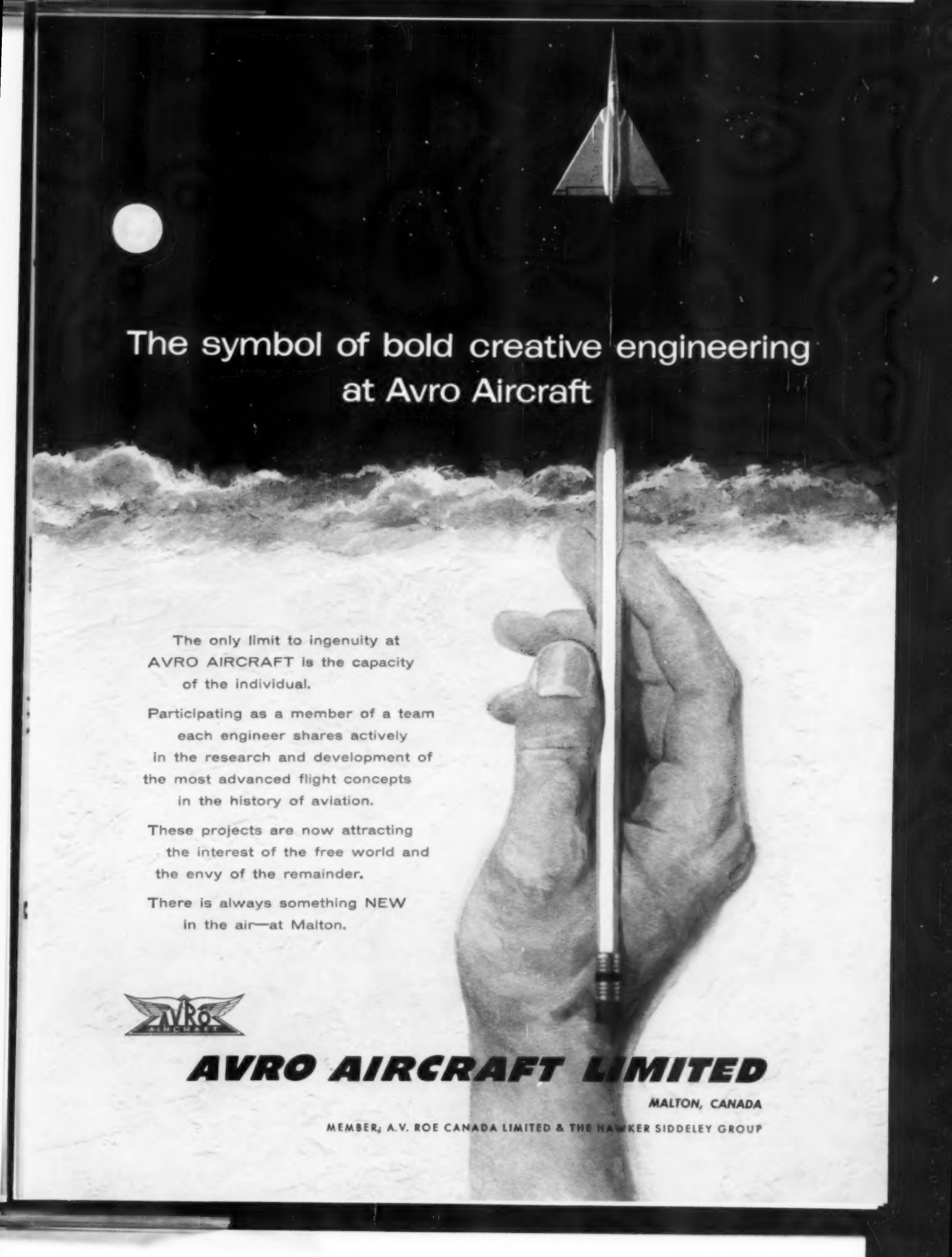
Pressure Transducers

A new differential pressure transducer which will read, calibrate and record differential pressure, differential suction, or straight pressure or suction, has been announced by the Aircraft Products Division, Manning, Maxwell & Moore, Inc.

The new instrument will handle all pressures or differential pressures from 0-200 psi., or 0-600 psi. Its sensitivity of 0.031 psi. remains constant throughout its entire operating range. To make the mechanism rugged, it is constructed without springs, bellows, diaphragms or Bourdon tubes.

The instrument presents readings on a 240-in. scale and on a column of mercury.

Address: Shelter Rock Lane, Danbury, Conn.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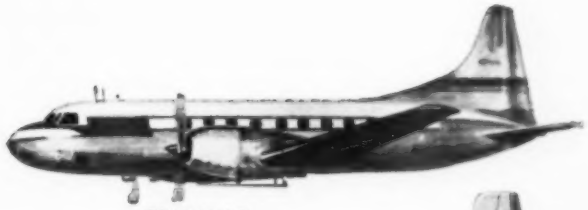

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Providing the correct conduit materials for mechanical remote controls is a good example of Superior's ability to supply a variety of analyses for specific needs. Because of the varied conditions of service encountered, Teleflex Incorporated, of North Wales, Pa., manufacturer of mechanical remote controls, subjects its products to exhaustive tests for strength at high temperatures and corrosion resistance. This concern also requires close tolerances for the tubing bore to assure perfect fit of the cable and ability of the tubing to be flared without cracking.

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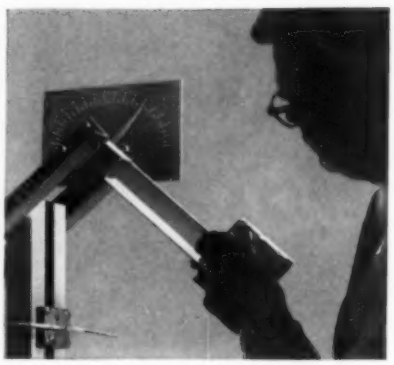

The impact test at the Teleflex laboratory measures the force the conduit will withstand before it crushes and interferes with the cable.

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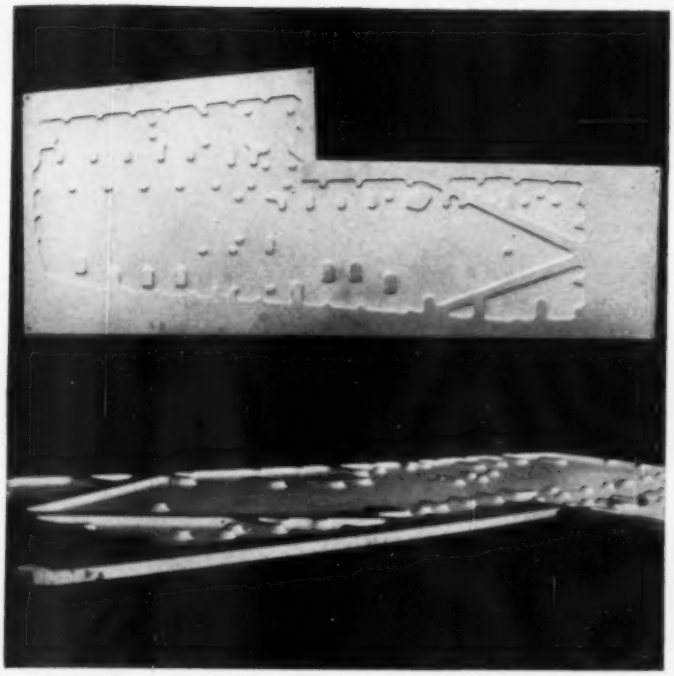
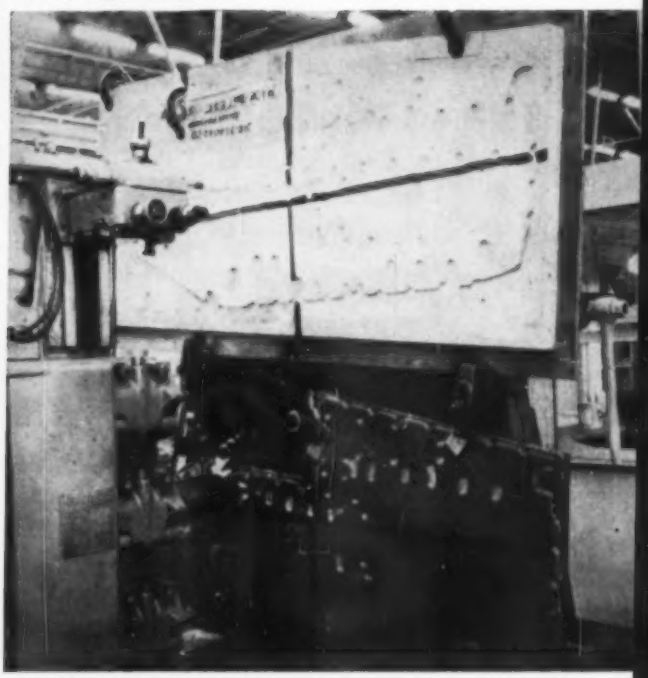
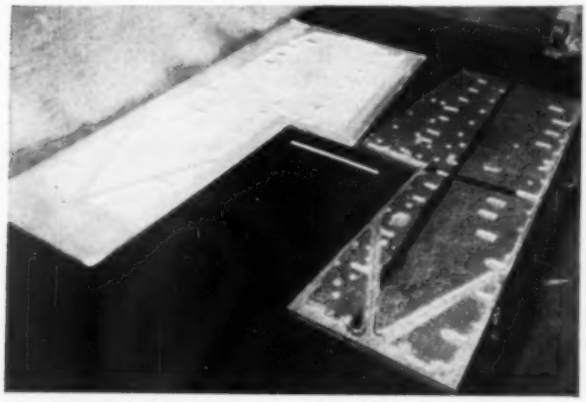


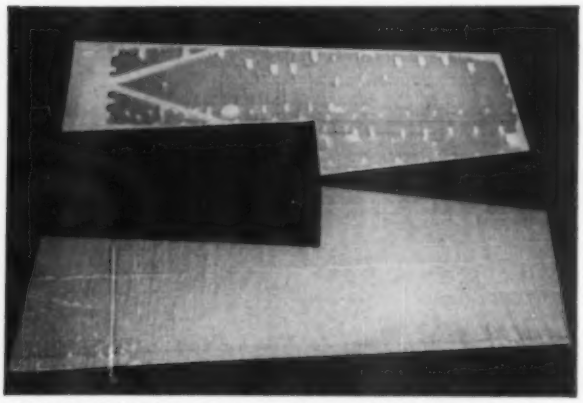
CHEM-MILLED skin's integral inserts simplifies sandwich structure.



PLASTER DUPLICATOR pattern (top); honeycomb core (bottom).



SCULPTURED CORE (right) and corresponding Chem-Milled face.



CLOSEOUT SKIN (bottom) faced with tape; Chem-Milled skin at top.

Low-Cost Technique Cuts Missile Cost

By Irving Stone

Downey, Calif.—A new cost-cutting technique that simplifies the use of sandwich structure in aircraft and missiles has been devised by the Missile Development Division of North American Aviation.

The new technique, which incorporates NAA's Chem-Mill process (AW Mar. 7, 1955, p. 40), solves many of the problems of fabricating and locating integral attachment inserts in adhesive-bonded sandwich structure. In a typical example, tooling time was 60% less than required formerly. Sandwich structures using integral inserts made by the Chem-Mill process have been utilized by the company for wing panels, pressure bulkheads, fuel lines, electrical duct tunnels, equipment mounting boards, and structural housings for required avionic guidance equipment.

Important Benefits

Result is a significant reduction in number of parts, tooling costs and production time. Another advantage of the integral insert is greater strength for the sandwich panel.

The conventional sandwich structure consists of two facings, core and miscellaneous separate inserts for attachment of mating structure or aircraft equipment.

Use of separate inserts often results in poor fitup between core and inserts. Under critical loading, this often causes premature panel failure. This condition is accentuated with the use of high temperature-resistant adhesives, which are inherently brittle and thus more affected by mismatching and resultant notch sensitivity.

Elaborate tooling is required for locating separate inserts in the panel and for matching cutouts in the core. Also

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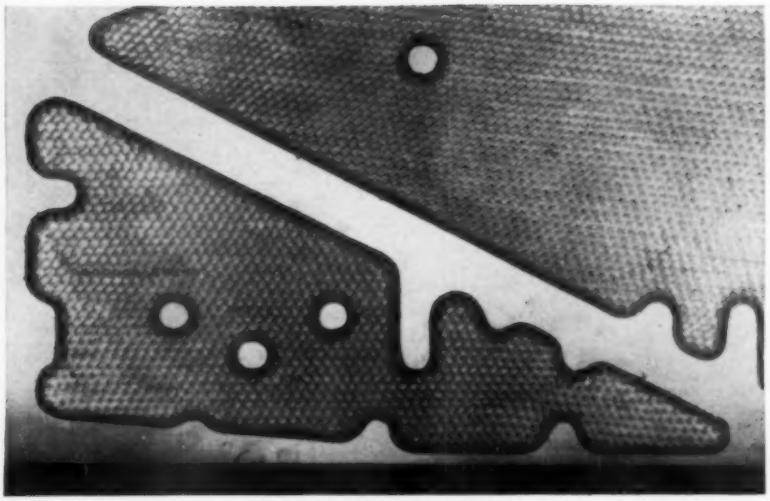

CORE MATERIAL positioned in Chem-Milled skin; small light areas are integral inserts.

involved is the tooling for each individual insert.

By fabricating inserts and edgings integral with the skin, through Chem-Milling, NAA avoids all these problems and is able to extend the use of sandwich structure with its strength and stiffness-to-weight benefits. These advantages result:

- **Tooling costs are slashed**, with chem-milling expense about one-eighth that of conventional machining of the inserts.
- **Detail part rejections are minimized.**
- **Flow time is drastically reduced** because so many operations with conventional machining and tooling are eliminiated with Chem-Milling.

Avionic Housing

A typical example of how NAA engineers are using Chem-Milled integral inserts and edgings in sandwich structure is a housing and mounting panel for airborne automatic guidance equipment.

Details of the design were outlined for AVIATION WEEK by R. W. Spencer and T. F. Freeman, senior staff materials research engineers at the Missile Development Division.

Design called for a high-strength, low-weight structure to operate at about 300F.

The housing, of which the panel is one member, was specified to be pressure tight. The panel had to provide inserts in areas where high local compressive loads were expected and for attachment of guidance equipment.

In the fabrication of the panel, a $\frac{3}{8}$-in. 24ST aluminum plate was masked to produce the desired insert (boss) location and configuration, then Chem-Milled to give a face of .040 in. with tolerance within .003 in.

For the opposite face, conventional 24ST .020 sheet stock was selected.

The core was Hexcel with $\frac{3}{16}$-in. cell size and .001-in. aluminum foil. The honeycomb was sawed and milled to final thickness in the unexpanded condition. It was then expanded, filled with a thermoplastic epoxy resin and affixed to a plywood panel.

Master Pattern

A master duplicator pattern locating the various radii, inserts and edge configurations was made by taking a plaster spash from the Chem-Milled skin into which the honeycomb core later would be assembled. This pattern also was

Equipment Tester

Huge vibration exciter is latest addition to North American Aviation's Downey plant environmental laboratory. Device can subject test equipment items for supersonic aircraft and missiles to 45Gs. Machine has continuous rated force output of 12,500 lb. Operating frequency range is from 2 to 2,000 cps. and provision is made for automatic changeover from constant displacement to constant acceleration. Device was developed by MB Mfg. Co., Inc., New Haven, Conn.

positioned on a plywood panel.

The plywood panels with pattern and core affixed were placed on a Keller duplicating machine and the core was sculptured to match the Chem-Milled skin. After the machining, the epoxy resin was melted from the core.

Skins and core were degreased and cleaned in accordance with pre-bond techniques.

Bonding of the sandwich components —Chem-Milled skin, other facing sheet and sculptured core—was accomplished with a high-temperature-resistant adhesive in .020-in. tape form. The adhesive was heat-pressed into the chem-milled skin to produce good bonding, not only at the normal faying surfaces, but in the radii as well.

Next, the components were assembled, bagged and step-cured under vacuum pressure at 180F for half hour, followed by 320F for one hour.

After the cure the panel was routed to final dimensions, drilled and tapped to match the mating holes on the equipment it would carry.

Compared to a conventional design using separate machined inserts, the Chem-Milled prototype showed a saving of 60% in fabrication time for tooling and detail parts.

Greater savings can be effected where minor design modifications are required, due to the simplicity of the tooling for Chem-Milled sandwich components.

Rocket De-Icer Sandwich

Napier Spraymat de-icing band on recovered rocket nose shows how it has resisted the effects of both kinetic heating and erosion in supersonic flight and the terminal impact. (De-icing would be necessary on supersonic missiles small enough to be carried externally by a slower aircraft until fired). Napier says that Spraymat is low in weight and high in thermal efficiency; it consists of an electrical-resistance heating circuit sandwiched between two coats of epoxy resin. All three coats are flame-sprayed on. U. S. manufacturing rights are held by Power Generators, Inc., Trenton, N. J.

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This new and improved MB-5900 mount will be used for P&WA's R2800-C engines. Tests prove that it's stronger than all previous mounts used.

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Along with stronger design, the MB-5900 mount saves weight. Only 20.7 pounds per engine set, it weighs less than any other mount for this job.

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Soviet Avionics, Part I:

Russian Hardware Lags Behind Theory

By Philip J. Klass

Soviet electronic hardware appears to be lagging behind advances in theory in the fields of computers, automatic controls and components.

This overall appraisal stems from observations made by Dr. W. H. Brandt, engineering manager of Westinghouse Electric Corp.'s Director Systems Dept., which handles the firm's industrial automation systems work.

It assumes the Russians put their best foot forward during a recent two-week tour of Red production and research facilities by a party of three U. S. engineers, including Dr. Brandt.

Here are some of Dr. Brandt's observations:

• **Semiconductors.** The Russians say they are "making progress in obtaining . . . steady characteristics" in their transistors. This suggests that they are going through the same troubles which plagued U. S. transistor makers before they developed improved manufacturing techniques and switched to hermetically sealed units several years ago.

• **Digital computers.** The Russian BESM digital computer, which Brandt calls "one of the most impressive achievements of Soviet technology," appears to be in the same league with present U. S. machines now in production but not up to our newest computers. The BESM makes very good use of memory devices, according to Brandt.

• **Automatic controls.** The Soviets are studying the use of digital control systems and have built one essentially analog type system which uses digital correction for certain types of errors.

• **Magnetic amplifiers.** The Russians appear to be somewhat behind the U. S. in their design of magnetic amplifiers, assuming the units seen at the Institute of Automechanics and Telemechanics represent the best the Reds can do, Dr. Brandt says. However, it should be pointed out that even in the United States, devices used in research and development laboratories to prove a circuit principle do not always reflect the latest or best manufacturing practices.

Speaking of the Institute of Automechanics and Telemechanics, Dr. Brandt says: "It is possible that some of the theoretical work going on here may be rather good. (However) it is nearly impossible to evaluate a theoretical program when working through a nontechnical interpreter." This communications problem explains some of the unfamiliar terminology used in Dr. Brandt's trip report.

Dr. Brandt, Dr. A. C. Hall, Research Director of Bendix Aviation Corp., and N. L. Bean of the Ford Motor Co., made their trip to Russia under private sponsorship, financed by their individual companies. However, Dr. Brandt says, "we were regarded and treated as guests of the Soviet government."

Brandt emphasizes that "there has been no restriction placed on our giving out information on what we saw and what we heard."

Purpose of the trip was to study Russian automation techniques. During the two-week period, the three men visited seven manufacturing plants and four research or development institutes.

DR. WELDON H. BRANDT, a PhD in physics, joined the Westinghouse Electric Research Laboratory in 1936. From 1937 through 1945, he specialized in the development of magnetic materials and high temperature alloys. Since 1946, Dr. Brandt has headed groups responsible for the development of servo control systems. In his present position as manager of Engineering for the Director Systems Dept. Dr. Brandt is responsible for the development of automatic controls, both digital and analog types, for industrial and automation use.

During a visit to the Institute of Precision Mechanics and Calculating Technology, Brandt saw the Soviet BESM digital computer (photos, p. 69). Intended for solution of scientific problems the BESM is a three-address, floating decimal point machine which carries five bits of information for command purposes and numbers of up to 11 digits. The BESM uses 5,000 tubes.

The Russians claimed that the BESM is "at least twice as fast as the IBM 701 on certain types of operation."

Four Types of Memory

This claim has been countered by International Business Machines Corp., which says the 701 can perform 14,000 calculations per second, compared to only 7-8,000 for the BESM. Further, IBM says its new 704 can perform 30,000 operations per second.

The Soviet computer utilizes four different types of storage devices:

• **Cathode ray tubes** for short-term storage during computation.

• **Diode matrix memory,** for storing problem constants.

• **Five magnetic drums.**

• **Four magnetic tapes.**

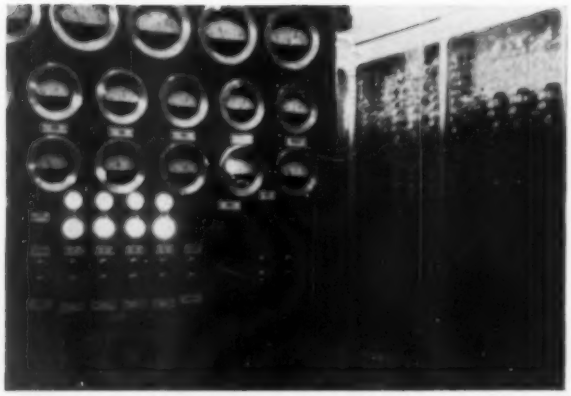
Brandt's description of the BESM's memory devices makes it sound very much like several U. S. computers. "The problem is set up and the machine takes information from the tapes or drums, works out a section of the problem and then sends the answers back to the drums or tapes. The next section of the problem is then set up.

BESM Operation

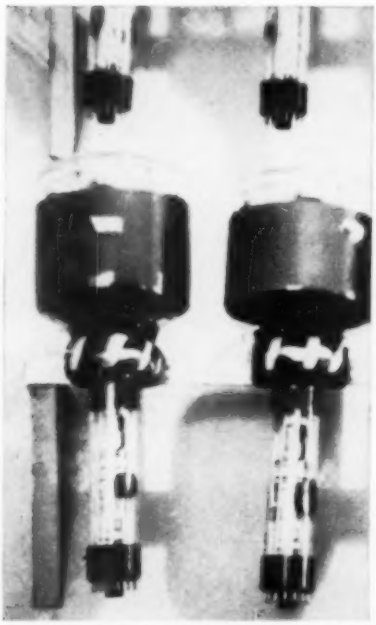
"They seem to have arrived at rather optimum use of these various types of memory in that they have some memory with rapid access, larger memories with somewhat slower access, and still larger with slower access still." (U. S. computers have been using multi-speed memory access for several years.)

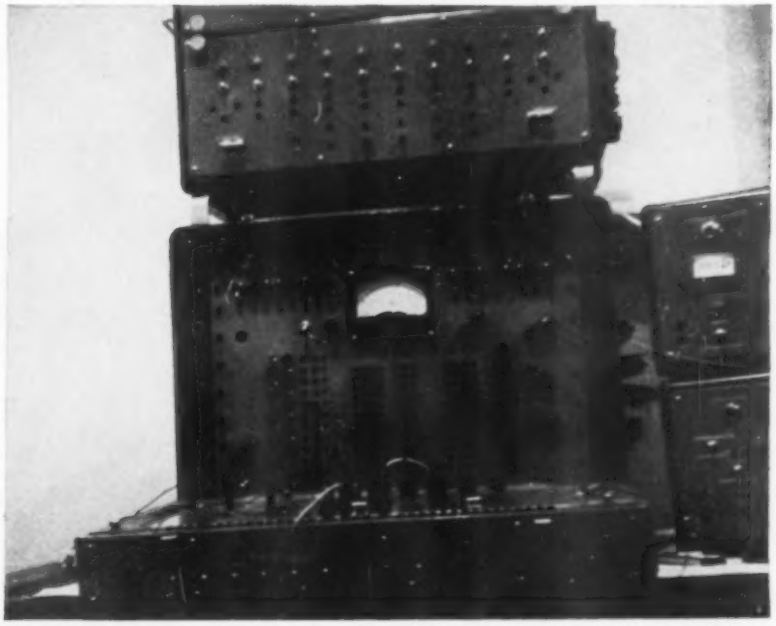
Brandt reports that the Russians operate the computer 24 hours a day but that about 20% of this time is spent in testing. Another 8% of the time is lost due to machine errors, so that useful time is about 72% of the total. The Russians estimate that BESM is the equivalent of 12,000 human operators, presumably operating desk calculators.

Of special interest to persons in the



BESM, Russian digital computer (l.), resembles U. S. machines and employs four types of memory, including magnetic tape (r.) and . . .





. . . **CATHODE RAY TUBE** (l.). **ANALOG COMPUTER** (r.) can handle sixth-order differential equations with non-linear coefficients.

avionics field was the visit to the Institute of Automechanics and Telemechanics, under the Soviet Academy of Sciences.

Brandt reported that the Institute's activities are broken down into three general categories:

• **General theoretical problems.** This includes such things as the theory of automatic control, telemechanics (control and telemetering at a distance), high-speed and non-linear mechanical devices, instrument precision and impulse type systems. Analytical work is often accompanied by experimental work for verification.

• **Digital control system theory.** This includes such things as the theory of Boolean Algebra and its application to measurement and control. Work is done on pneumatic, hydraulic and electric systems.

• **Automation of industrial processes.** These activities are largely of a consulting nature.

Relay Systems

The Russians apparently make considerable use of relays as control devices in their servo systems in place of the more sophisticated proportional control obtained from electronic or magnetic amplifiers. As a result, they have done considerable work on the theory of signals and relay logic systems and the signals used in error detecting systems, Brandt reports.

For example, the Russians are studying the advantages and disadvantages of using different pulse frequency and pulse length in impulse-type control systems. Theories on the optimum design of such systems are expected to be ready for application to practical systems soon, the Russians told Dr. Brandt.

In connection with their work on the theory of contact systems, the Russians report that they have advanced beyond Boolean Algebra techniques by working out more general methods of system simplification.

Digital Control Systems

In addition to reporting that they had built digital servos, the Russians said they had built a hybrid system

Soviet Avionics

The article beginning on page 68 is the first of two detailing the state of the Soviet avionics art as reported by first-hand observers. The second article will appear next week.

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Russians Have Reliability Problems

The U. S. is not alone in its concern over the reliability of electronic equipment. Dr. W. H. Brandt reports that the Russians have set up a Reliability Laboratory, concerned chiefly with industrial telemetering, in their Institute of Automechanics and Telemechanics.

This laboratory studies the effects of precision, influence of errors and the reliability of instruments themselves, Brandt reports. "They use a parameter they refer to as 'coefficient of transmissions.' This seems to be a reliability parameter and is probably a sort of correlation coefficient between input and output. They have developed a theory of potential error stability which is a statistical method of error analysis," Brandt reports.

The Russians, according to Brandt, divide the problem of designing a system of optimum effectiveness into two parts:

- Choice of suitable codes, methods, etc.
- Use of statistical methods in handling information.

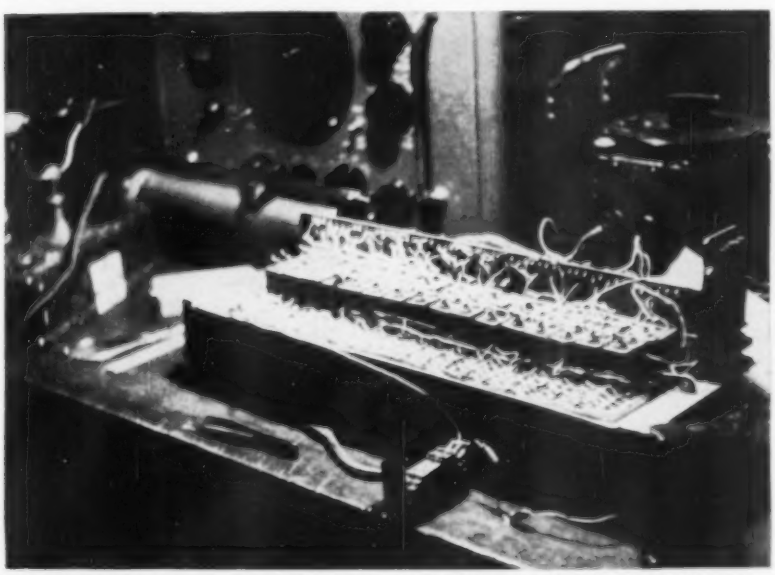
which is basically analog, with "a few final corrections applied by digital means." Although time lags are normally considered deleterious in analog servo systems, the Russians say they use delays, based on digital techniques, to improve system performance.

The U. S. visitors were shown a magnetic amplifier control for a ½-hp. motor which used a tachometer generator for stabilization, and three stages of amplification in which the first stage was electronic, the last two magnetic. The last stage was said to have a gain of 10 and a time delay of 0.2 second.

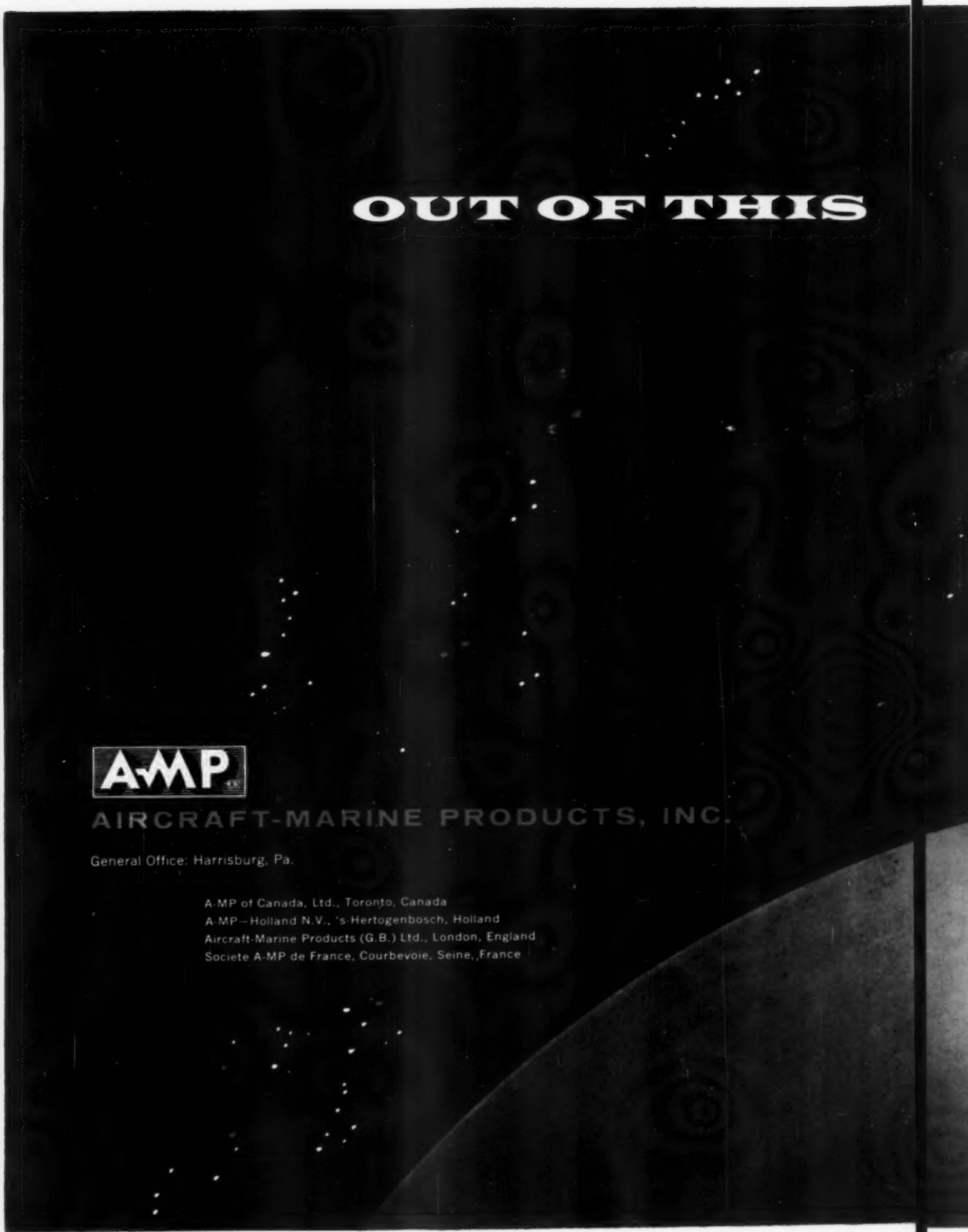
"In another section, they are doing work on analog servo systems, again using theoretical methods which are checked by experiment," Brandt says. "The transient response methods of Brown and Campbell (U. S. engineers) were mentioned, as was analysis of quality of servo systems by amplitude and phase characteristics. The Floyd system of error analysis was mentioned, based on calculations using $\frac{Sin\ X}{X}$. They have worked up a similar method using special functions."

In a laboratory which Brandt visited, devoted mainly to pneumatic and hydraulic controls, he noted that "they have set up an experimental hydraulic system that works on the principle of changing pressure on the power piston rather than by controlling displacement. With this equipment they are able to set up several stages of hydraulic amplification and make various arrangements of feedback."

The Russians are working on impulse-type telemetering systems with "eight channels which employ frequency modulation with the channels distributed in time," Brandt was told. "They use a 200-cycle band with a base frequency of 4 to 5 kc. They claim that by this method they are able to use a smaller number of tubes and amplifiers and



PULSE-TYPE data transmission is being investigated by the Russians with the set-up shown above, which consists of what appears to be a time-delay network.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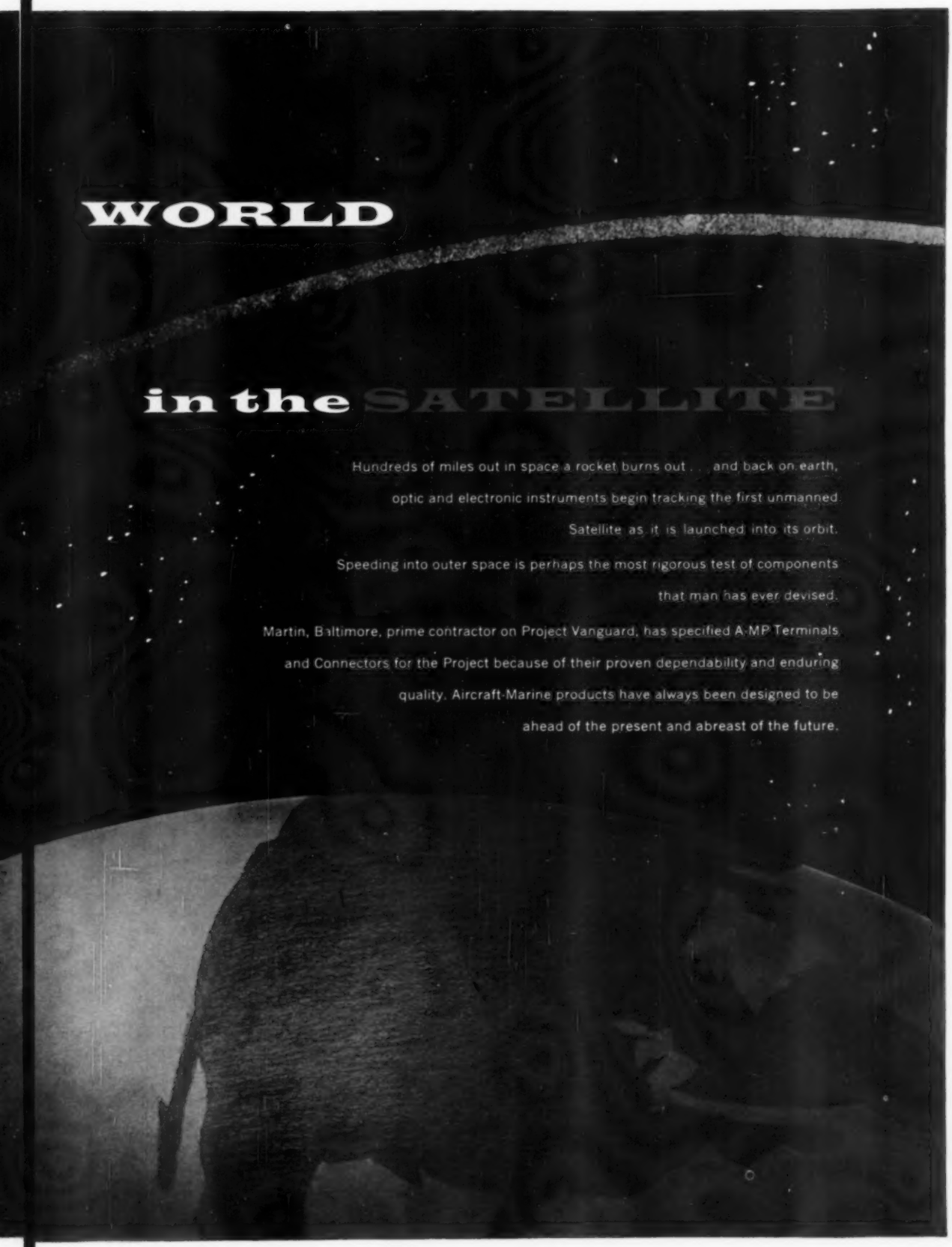
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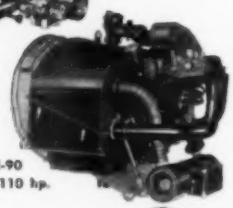

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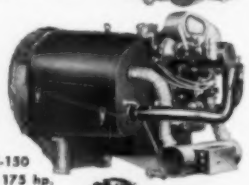
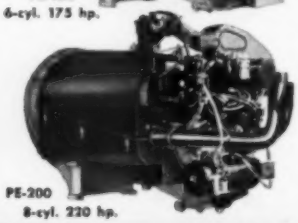


PE-130
6-cyl. 175 hp.



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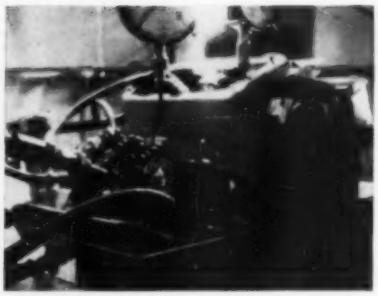


TWO-STAGE HYDRAULIC force amplifier was shown to Dr. Brandt by the Russians.

that the accuracy achieved is 1½%," Brandt says.

Brandt saw an analog computer capable of solving sixth order differential equations, linear and non-linear. Accuracy was quoted at about 5%, not up to U. S. standards. Answers were visually displayed on a cathode ray scope.

The computer consisted of a console about four ft. high, containing the controls for solving any straight linear problem (photo, p. 69).

Atop the console was another chassis into which plug-in modules, each representing a desired function simulated by diode networks, was plugged. From its picture, the Russian analog computer does not appear to be as easy to operate as its U. S. counterparts.

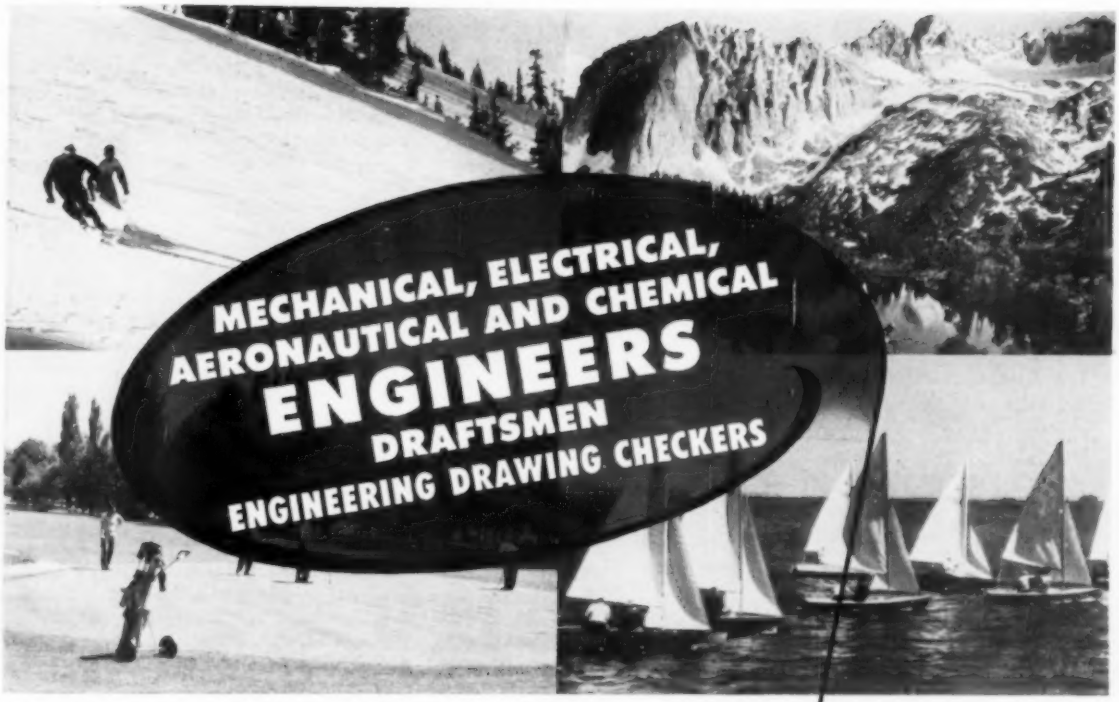
The subminiature diodes used in the networks were the only subminiature tubes which Brandt saw during his visit, although he observed miniature tubes in use elsewhere. He notes that the analog computer was compactly constructed, perhaps too compactly, because it appeared to run rather hot.

Brandt concludes that the Institute appears to be "doing better work in hydraulic and pneumatic servo systems than they are doing in electrical control systems." He adds that "better work has been done on both types of systems in this country as long ago as seven or eight years. At the same time it should be remembered that some of the most advanced servo work in the United States has been done in the military field. If this is also true in Russia, we would not have had an opportunity to witness it."

Soviet Components

With this qualification in mind, Brandt also observed that "in the field of magnetic amplifiers, they seem to be behind by some years, assuming that the work we saw here was the best they are able to do."

During a visit to the Krasny Zarya Factory at Leningrad, under the Ministry of Radio Technology Industries, which produces automatic telephone exchanges, Brandt found that "considerable progress has been made in auto-



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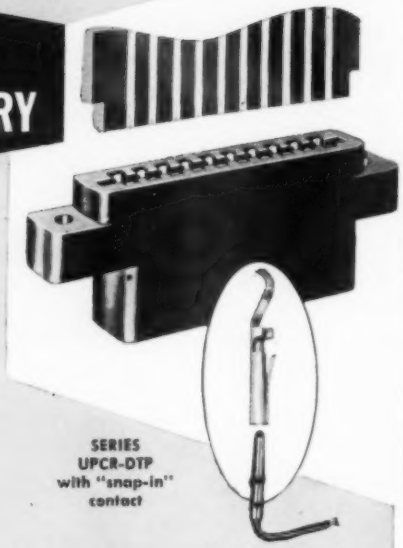

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mating the final inspection of these switchboards."

Watching the Reds winding small coils one at a time, Dr. Brandt observed that the techniques were comparable to those found in the U. S. prior to World War II.

On the subject of transistors, in addition to previously cited troubles with obtaining "steady characteristics," the Russians indicated that work on silicon-type transistors is only beginning.

During a visit to the Experimental Scientific Research Institute for Metal Cutting Machine Tools (ENIMS), Brandt was told that relays used to control machine tool motors had a life of about one million cycles, but that "the life would be much better if they could coat the contacts with silver or gold."

Reds Pay Scientists Well

Figures which Brandt obtained confirm that the Soviets pay their engineers and scientists well, at least by Russian standards. For example, at ENIMS, engineering salaries run from 1,400 to 1,800 rubles per month, with top salary of about 3,000 rubles, except for the chief engineer who earns 4,000 rubles per month. However, bonuses of up to 2,000 rubles per month can raise the engineer's take-home pay.

Because official international exchange rates can be misleading, it is interesting to evaluate these salaries in terms of the cost of a Russian bicycle, which runs about 620 rubles, according to Brandt. On this basis, the chief engineer at ENIMS could buy approximately 10 bicycles with a month's salary and bonus.

Based on the going U. S. price of bicycles, this would place the chief engineer's salary at around $400-$500 per month. It would take about three to four months salary and bonus for the ENIMS chief engineer to buy a four-cylinder, 52-hp. Pobyetta automobile.

If this seems rather modest pay for a top engineer by U. S. standards, it should be remembered that an average worker, say in the Stalingrad tractor plant, earns only about 800-900 rubles per month. Engineers at the same factory start at the same figure, but can move up to as high as 2,500 rubles per month, Brandt was told.

Average salary of the 450 engineers employed at the Institute of Precision Machines and Calculating Technology is about 1,800 rubles per month, Brandt learned. The director of this and other research institutes is nearly always a member of the Academy of Sciences, Russia's top scientific body. Such an academician gets a monthly salary of 5,000 rubles just for being a member of the Academy, plus another salary as director of his particular institute.

FILTER CENTER

▶ **Transistor "Breakthrough"**—Another new transistor, called the "grown-diffused" type, reportedly can operate at useful power levels at over 100 mc. and oscillate at 250 mc. The new technique was developed by Texas Instruments which says it already is producing the new type units. One, a silicon transistor, produces a gain of 15 db. at 12.5 mc., and 14 db. at 30 mc. with useful power levels. A grown-diffused germanium unit, now in production, gives a 10 db. (minimum) gain at 100 mc. with collector dissipation at 25 mw. at 75C. Cutoff frequency is 200 mc.

▶ **Nice Touch**—In the industry's mad rush to recruit new engineers, at least one company, Sperry-Rand Corp., has not forgotten to honor its "old timers." The Sperry Engineering Review, which comes out every other month, devotes a regular section to biographical sketches of engineers who have completed 15 years service with the company.

▶ **Successful Marriage**—National Bureau of Standards reports that it has wedded the SEAC and the newer DYSEAC high-speed digital computers to cooperatively work out a data processing task. The problem simulated a situation in which stock transaction reports were tabulated and summarized for posting to inventory control records located at some remote site. SEAC tabulated and summarized the stock transaction reports, then signalled DYSEAC and transferred the data to the latter for

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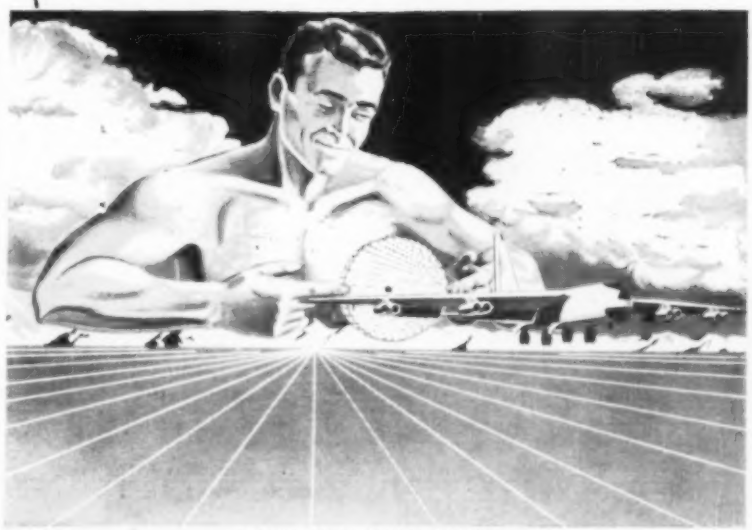

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Ejected Pilot" by West Coast
Editor W. J. Coughlin

OCTOBER

Engineering Article
"Dassault Designs NATO Light
Fighter" by Asst. Managing
Editor (Tech.) David A. Anderton

SEPTEMBER

Engineering Article
"NACA Formula Eases Supersonic Flight"
by Asst. Managing Editor (Tech.)
David A. Anderton

IRVING STONE, AVIATION WEEK Engineering Editor, holds a Mechanical Engineering degree from Polytechnic Institute of Brooklyn, and the degree of Doctor of Jurisprudence from New York University. Mr. Stone was Supervisor of Training Literature at Air Force Technical School, Chanute Field, Ill. in 1941-42. He served as Chief of Instructional Materials at Air Force Technical School, Seymour Johnson Field, N.C., 1942-44. As Assistant Chief Instructor at the same field in 1943-44, Mr. Stone supervised 2,500 civilian and enlisted instructors and some 25,000 student mechanics. Mr. Stone was Administrator, Department of Plans and Training, Air Force Engineering Cadet Course, Yale University, 1944. He joined the staff of AVIATION magazine, AVIATION WEEK's predecessor, in 1944, and later served as Engineering Editor of AIR TRANSPORT. Mr. Stone is a member of the Institute of the Aeronautical Sciences and Aviation Writers Association.

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posting. As soon as DYSEAC had accepted the data, SEAC continued tabulating and summarizing. The Bureau says the experiments showed that two digital computers need not have identical operating characteristics to work together, providing one of them has the necessary control flexibility.

▶**Midget Magnetron**—Two tiny CW magnetrons, developed by General Electric, measure only ¼ in. in diameter and ½ inch long and are voltage tunable over the frequency ranges of 2,500 to 4,000 mc., and 4,200 to 4,400 mc. The S-band magnetron, Type Z-5040, delivers ½ to 1 watt, while the C-band unit, Type Z-5098, puts out 2 to 3 watts. Tuning gradients are 2.75 mc./volt and 4.0 mc./volt for the S-band and C-band units, respectively. The thimble-sized CW magnetrons were developed under Signal Corps sponsorship. Details are available from GE's Power Tube Sub-Dept., Schenectady, N. Y.

▶**New RTCA Members**—The Burroughs Corporation Research Center, Paoli, Penna., and the Fairchild Guided Missiles Div., Wyandach, N. Y. have been elected to membership in the Radio Technical Commission for Aeronautics.

KLM

ROYAL DUTCH AIRLINES

have vacancies on their European and intercontinental routes for

7 DC-4 captains

7 DC-4 co-pilots

Minimum requirements for captains:

a. Valid Airline Transport License with instrument- and night-ratings;

b. Valid Navigator License;

c. 6000 hours including 4000 hours in command, flown on long range - and European routes.

Minimum requirements for co-pilots (first officers):

a. Valid Airline Transport License with instrument- and night-ratings;

b. 2500 hours flown on long range - and European routes.

KLM ROYAL DUTCH AIRLINES

Applications - with photograph - to be directed to:

KLM ROYAL DUTCH AIRLINES,

Personnel Division Flying Staff,

Building 101,

SCHIPHOL - AIRPORT

The Netherlands

U.S., French Firms Form New Avionic Co.

Airborne Instruments Laboratory, Mineola, N. Y., and the French Compagnie Generale de Telegraphie Sans Fil (CSF) have formed a new U.S. company to be known as Intercontinental Electronics Corp. to manufacture and market electronic products developed by CSF.

These will include radar, microwave links and test equipment.

The new firm, which will be headquartered in Mineola, has authorized 1.5 million shares, of which 250,000 have been issued as follows: AIL (40%), CSF (40%), The Bank of Paris (5%), J. P. Morgan Employee Pension Trust Fund (10%), and American Research & Development Corp. (5%).

Robert F. Schulz, former manager of Motorola's Microwave Division, will head the new firm.

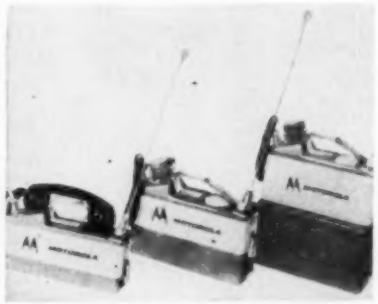
Expansions, Changes In Avionics Industry

Federal Telecommunications Laboratories, Nutley, N. J. has opened a West Coast branch in Los Angeles to meet the growing needs of that area's aviation and electronics industry.

The new facility, which occupies the first of a projected series of five structures in the San Fernando Valley, is headed by Paul R. Adams. Address: Bledsoe St. and San Fernando Road, Los Angeles.

Other recently announced expansions and changes in the avionics industry include the following:

• **Helipot Division of Beckman Instru-**



Talkative Family

Handie-Talkie portable two-way radiophones, for use in the 25-54 mc. and 144-174 mc. band, provide 1 to 1½ watts of transmitter power, depending upon the band, in units left and center, 5 to 8 watts in the super-power model, right. Units are available with handset or mike and speaker, dry or rechargeable nickel-cadmium batteries. Motorola Communication & Electronics, Inc., 4501 Augusta Blvd., Chicago 51, Ill.

ments, Inc., Los Angeles, has broken ground for its new $2 million plant at Newport Beach, Calif. Initial buildings on the 15-acre site will provide more than 150,000 sq. ft. of floor space. Completion is scheduled for late this year.

• **Production Research Corp.,** Thornwood, N. Y., maker of high frequency and microwave antennas and devices, has been purchased by Everett Frank and Harrison Johnston and a group of associates. Johnston, formerly manager of Ampex Corporation's International division, has been named president of PRC. Leon Hillman will continue with the firm as senior vice president.

• **The W. L. Maxson Corp.,** New York, has acquired "a substantial interest" in Roger White Electron Devices, Inc., Ramsey, N. J., maker of microwave tubes and equipment.

NEW AVIONIC PRODUCTS

Components & Devices

• **Frequency standard,** Type 2111C, delivers 75 watts of a.c., adjustable between 0 and 135 v., available for any frequency between 50 and 1,000 cps. Accuracy of frequency reference is 20 parts per million at temperatures between 15 and 35C. Device weighs 25 lb., operates from 115 v., 50 to 100 cps. Company also makes a miniature precision tuning fork with a plug-in nine-prong base, which can be operated at 125C. Type 50 is accurate to within 0.02% between −65C and 85C. Type R50 is accurate to within 0.002% from 15C to 35C. American Time Products, Inc., 580 Fifth Ave., New York 36, N. Y.

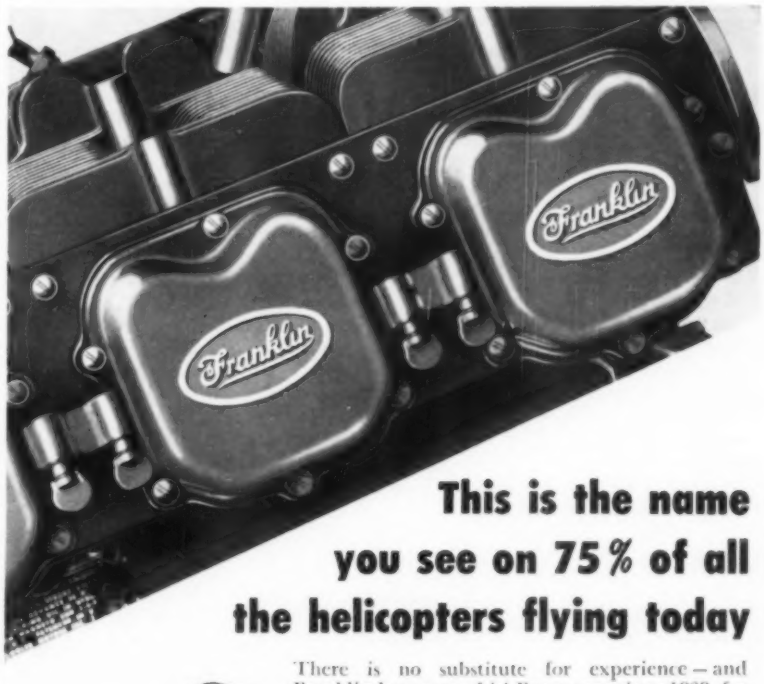
• **Bonded silicon diode,** Type CK863A, has peak inverse voltage rating of 300 v., operates over temperature range of −55C to 150C. Reverse current is only 0.1 microamp. at minus 275 volts, manufacturer says. Forward current is 3 ma. at 1 volt, and maximum forward current is 10 ma. at 150C. Complete data is available from Technical Information Service, Raytheon Manufacturing Co., 55 Chapel St., Newton 58, Mass.

Production Line Testers

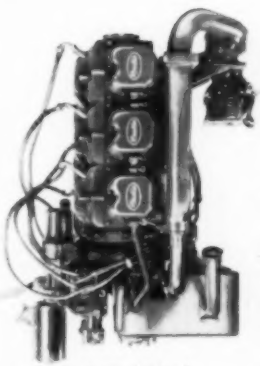
• **Transistor tester,** Model GP, provides rapid measurement of transistor characteristics over frequency range of 100 cps. to 1 mc., for both n-p-n and p-n-p junction, surface-barrier, and point-contact transistors in grounded base or emitter circuits. Unit measures hybrid coefficients, T-network coefficients, collector saturation current, capacitance, alpha and beta cutoff, voltage feedback ratio, open circuit resistance and channel effect voltage. Baird Associates, 33 University Road, Cambridge, Mass.

• **Digital frequency-period counter,** Model 201A, a five-decade counter, has crystal oven to provide reference frequency accurate to within 0.0001%. Unit provides time cycle bases up to 10 seconds. Input sensitivity is 0.05 v., 10 cps. to 100 kc., 0.07 v. from 1 to 10 cps.

Frequency measuring range is 1 cps. to 100 kc. and measuring period range is 10 microseconds to 1 second (automatic) and 1 second to unlimited (visually). Short term stability is quoted at 1 part in 1 million. Computer-Measurements Corp., 5457 Cleon St., No. Hollywood, Calif.



This is the name you see on 75% of all the helicopters flying today



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Franklin POWER

BUSINESS FLYING

Aerial Applicators Defy Crop Planners

By Erwin J. Bulban

College Station, Tex.—U. S. aerial applicators are rapidly gaining a technical skill in their "tactical warfare" against the farmer's natural enemies. Their proficiency, in fact, has reached the point where it threatens to frustrate the best-laid efforts of government planners to control agricultural production.

Their degree of efficiency was made unmistakably clear in a sequel to a 1954 government order taking a million acres of cotton out of production in Texas. Despite this, 13% less acreage, aerial applicators are credited with enabling the state's farmers to grow the same amount of cotton last year as in the previous period.

The applicator's skills are constantly being sharpened through an ever-increasing number of conferences at top-notch American colleges such as the Texas Agricultural & Mechanical College System here, where scientists brief them on research being done on insects and other pests, chemicals and their application and meteorology.

More than 300 applicators, operators and their wives attended the fifth annual Agricultural Aviation Conference held here recently at Texas A & M. The conference was sponsored by the College System, the Texas Aeronautics Commission, Texas Flying Farmers & Ranchers Assn. and the Texas Aerial Applicators Assn.

Industry Critique

In a frank critique of the industry, John F. Neace, manager of the Marsh Aviation Co., Phoenix, Ariz., and vice president-agricultural activities of the National Aviation Trades Assn., told delegates:

"We carry the war to the communists everytime we put a plane-load of chemicals into the air. We do that because we're providing close support to the farmer in his food production battle—a battle in which 13% of America's citizens feed all of this country and a good part of the rest of the world; while in Russia it takes 60% of the people to feed that nation—and a lot of them are hungry."

Despite the job they are doing, Neace warned the applicators, the general public thinks of them as "ex-juvenile delinquents . . . idiots flying decrepit planes . . . yet our safety record last year was better than that of the U. S. Navy and Marine Corps combined."

Strongly critical of price-cutting cut-throat competitive practices still prevalent, Neace said that there are 779 potential customers for every U. S. agricultural airplane. He noted that there are some 2,000 aerial applicator firms, old and new, in business in the U. S. today. In the past, however, tough competition has resulted in 12% of the total number of going firms having to declare bankruptcy every year.

Aerial applicator expenses were broken down this way by Neace: 45 cents of each dollar for inventory, 17 cents for taxes, 16 cents on employes and 13 cents to finance companies, leaving nine cents profit for the operator.

Chemical Application

One of the major problems faced by aerial applicators is how to distribute material evenly in the face of crosswinds, disturbances caused by airflow along the airplane, propeller slipstream and wingtip vortices.

There is constant experimentation by the operators and agricultural research workers on dispensing equipment, the best location of nozzles, spray pressures and droplet sizes to solve this problem. Suggestions made by researchers at the Texas A & M conference included:

• **Spray equipment** that would produce all drops with diameters larger than 100 microns was recommended for use with herbicides by Richard Behrens, U. S. Department of Agriculture. Drops should be maintained at approximately 70 or more per square inch to give effective results. When Diesel oil is used as a carrier, low-volume applications are necessary to avoid rapid leaf kill which may reduce the effectiveness of the herbicide.

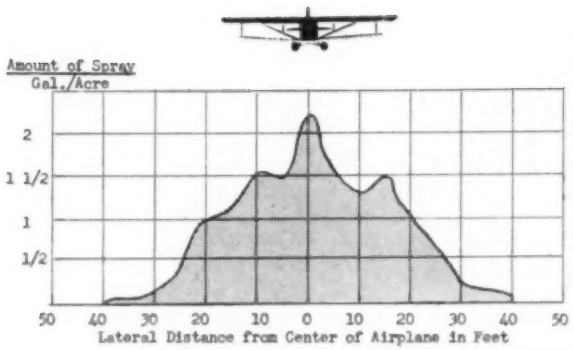
Past recommendations have suggested that the largest drop size possible should be used in aerial application of herbicides; however, tests indicate that smaller droplets of the size recommended would be more effective, particularly when using 2,4,5-T.

• **Need for uniform droplet size** was confirmed by George A. Roth of Texas A & M's Aircraft Research Center. Roth said a spray composed of uniform droplets would provide more predictable and even drift characteristics that could be correlated to offset crosswinds.

Roth also discussed some recent tests with nozzle arrangements for Piper PA-18A Super Cub and Stearman biplane aircraft which he said should provide more uniform distribution patterns than with many presently used arrangements (see diagram p. 83).

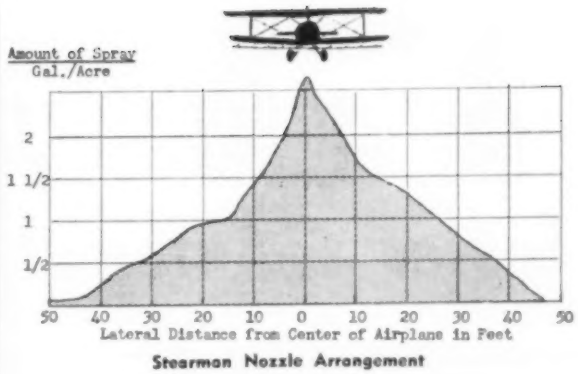
He detailed tests made by the Research Center that included a range of

TYPIFYING INDUSTRY INTEREST in developing new aircraft to replace current obsolete types is Piper PA-25/Weick Ag-3 testbed which is providing ideas for light spray/duster.



PA-18A Nozzle Arrangement

Conditions:	Nozzle Locations (Distance from Center of Aircraft).	
	Left Wing	Right Wing
Crosswind—Near Zero	2′–3″	1′– 2″
Swath Spacing—40 ft.	4′–2″	1′– 9″
Airspeed—80 mph.	6′–2″	3′– 0″
Height, Wheels above Ground—5 ft. (nominal)	7′–1″	4′– 1″
	8′–0″	6′– 6″
Density of Application—2 gal./acre	8′–7″	7′– 5″
Rate of Flow—12.8 gal./min.	9′–1″	8′– 3″
Nozzles—23 Spraying Systems Co. D8–45	10′–0″	9′– 3″
	11′–3″	9′–10″
Spray Pressure—35 psi.	13′–0″	10′– 6″
Spray Fluid—Water	14′–1″	12′– 3″
Median Dia. Droplet—320 microns		14′– 1″



Stearman Nozzle Arrangement

Conditions:	Nozzle Locations (Distance from Center of Aircraft)	
	Left Wing	Right Wing
Crosswind—Near Zero	0′–6″	1′–6″
Swath Spacing—40 ft.	2′–0″	2′–4″
Airspeed—90 mph.	3′–6″	3′–0″
Height, Wheels above Ground—5ft. (nominal)	5′–0″	3′–4″**
	6′–6″	3′–8″**
Density of Application—2gal./acre	8′–0″	4′–0″**
Rate of Flow—14.4 gal./min.	9′–6″	4′–8″
Nozzles—21 Spraying Systems Co. D12–45	10′–6″	6′–4″
	12′–0″	8′–4″
Spray Pressure—35 psi.		10′–0″
Spray Fluid—Water		11′–0″
Median Dia. Droplet—320 microns		12′–0″

**These 12″ below normal boom location

crosswinds of up to eight miles per hour, providing data that showed radical changes in the trapezoidal system of distribution which had provided satisfactory coverage with cross currents of less than one-quarter mile per hour and a 50-ft. swath spacing.

An increase in crosswind resulted in a definite and progressive change in swath pattern, changing from a nearly symmetrical and uniform trapezoid to one which was narrower, irregular and with a pronounced hollow near the center. Even a crosswind of only two-miles-per-hour caused overall distribution to be very irregular. There were points of deposit 60% below average as well as some 55% above.

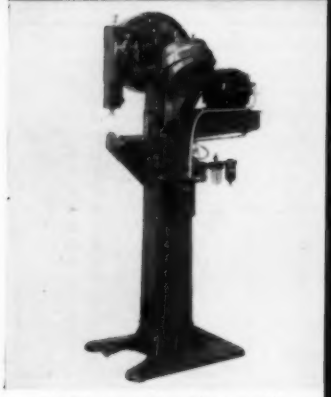
Swath spacing was reduced to 40-ft. and distribution was improved so that variance from the average at swath overlap was 35% compared with 45% for the 50-ft. spacing. Varying the wheel height above the weighing units showed the probable futility of such tactics: with a crosswind of over one-half-mile-per-hour the pattern became uneven with steep slopes and over-concentration on the upwind side and a definite hollow and under-concentration in the center.

Tests of vortice effects with a Bell helicopter showed that a violent wake was produced at a low speed of 15 mph. and that, contrary to popular belief, actual air currents at the end of the

LATEST SPRAY/DUSTER to reach the field in numbers is the new Callair, seen flying at typical operational altitude. Cockpit is offset to the left; chemical hopper is on right.

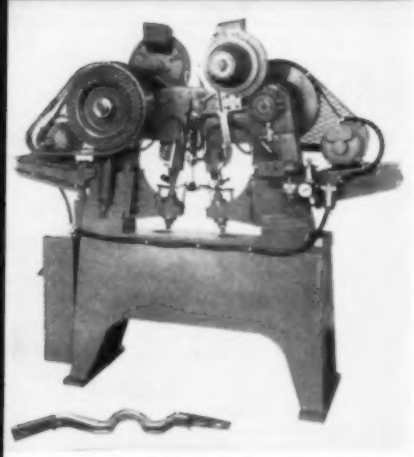
BACKBONE of agricultural plane fleet still is large fleet of greatly modified Stearman surplus World War II trainers supplemented by some older types of pre-WW II vintage.

T-J does your riveting and clinching Faster... Automatically!



T-J Clinchors adaptable to a wide range of clinch nut setting problems. Gravity feed model shown here.

CLINCHORS



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RIVITORS

Automatic feeding and setting with T-J Rivitors and Clinchors help you reduce labor and step up SPEED in a wide range of assembly jobs for aircraft, automotive, farm machinery, stampings of all kinds.

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Write for Clinchor bulletin 555; Rivitor bulletins 646 and 555. The Tomkins-Johnson Co., Jackson, Mich.

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39 Years Experience

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Granular Chemicals

The possibility of obtaining maximum swath distribution of granular-type chemicals by using a semi-conventional dust distributor with discharges no more than six feet either side of center was brought out by J. C. Chamberlain and V. D. Young, Department of Agriculture, Forest Grove, Ore.

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An experimental 12-ft. spreader was tried that provided a swath of approximately 50-55 ft. at the rate of 20 lb./acre at an altitude of 10 ft. However, the flat plate area and parasitic drag produced by this device reduced airspeed from 90 to 75 mph.—considered unduly dangerous. The researchers plan to continue experiments with wide spreaders with airfoil characteristics to reduce this drag and yet provide supplementary vortices necessary for wide distribution.

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Basically, the device acts on the principle that the rate of which the smoke puff dissolves is a function of the turbulent mixing of air at low levels, and by measuring the time for which the puff remains visible, turbulence values can be ascertained.

The principle of using turbulent mixing in this meteorological aid was de-

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Simple as the method seems, it has saved one large operator some $30,000 a year in increased efficiency.

Pan-Am Southern Gets Lightweight Lodestar

Hundreds of pounds were shaved off a Lockheed Lodestar executive transport converted by Executive Aircraft Service, Inc., Dallas, Tex., for Pan-Am Southern Corp., New Orleans by using lightweight materials and relocating equipment.

The conversion center provided an airplane weighing 13,380 lb. empty with a useful load of 6,120 lb. Powered by Wright R1820-71 engines, delivering 1,250 hp. on takeoff and 550-hp. each cruising, the Lodestar delivers 218-mph. cruise speed on the latter power setting, Cliff Conrad, Pan-Am Southern's pilot reports. Standard tankage is 644 gal. At an average of 85 gph., range is a little over seven hours.

Important weight savings were made by locating all radio equipment between the wing spars; grouping the equipment in this area minimized wiring lengths, cutting about 220 lb. over standard layouts. Additional savings were realized by eliminating the exhaust-type heaters and installing a Janitrol unit in the No. 2 baggage compartment. About 200 lb. were also saved by extensive use of Formica-surfaced balsa wood for interior furnishings. The nose section was left as free as possible for future installation of radar and additional navigation equipment.

BASIC LOADS

Engineers with training and experience in this field will be interested in new developments at Lockheed Missile Systems Division.

New positions have been created for:

- **Basic Load Engineers**
- **Structures Engineers**
- **Aerodynamic Engineers**
- **Dynamics Engineers**

to work on basic loads caused by high performance configurations, specialized missile systems criteria, unique recovery provisions and new environmental conditions associated with many types of advanced missile design.

The positions require an M.S. Degree in Mechanical, Aeronautical or related fields of engineering and at least two years' experience in loads, dynamics or aerodynamics, including transonic or supersonic aerodynamics. Equivalent experience will be considered.

Because of planned expansion in this department, the positions offer unusually favorable opportunity for promotion to supervisory level.

Those possessing a high order of ability applicable to this field are invited to write.

Lockheed

MISSILE SYSTEMS DIVISION

research and engineering staff

LOCKHEED AIRCRAFT CORPORATION

VAN NUYS, CALIFORNIA

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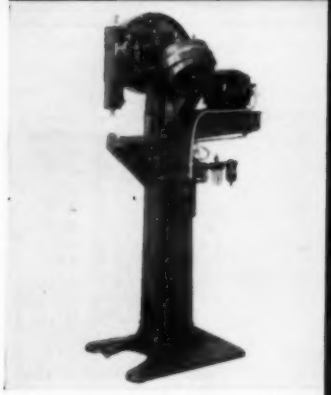

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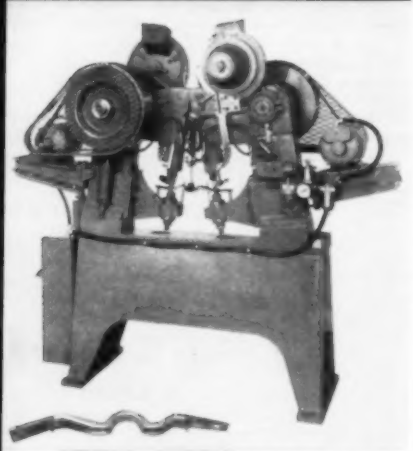

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- Aerodynamic Engineers
- Dynamics Engineers

to work on basic loads caused by high performance configurations, specialized missile systems criteria, unique recovery provisions and new environmental conditions associated with many types of advanced missile design.

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Those possessing a high order of ability applicable to this field are invited to write.

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Engineering Ahead for a Better Tomorrow

NORTH AMERICAN AVIATION, INC.

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Ercoupe Rejoins Private-Plane Field

Production of an improved version of the two-place spinproof Ercoupe private plane has been revived after a six-year lapse.

First deliveries of the Aircoupe, as it is now called, are scheduled to begin within 60 days from Forney Manufacturing Co.'s Aviation Division. The first Aircoupe was rolled out in mid-December. Five more aircraft are on the production line.

Price of the new model is estimated at $5,000. The Aircoupe is powered by a 90-hp. Continental engine turning an all-metal McCauley propeller. Flight tests show that the airplane has a true airspeed of 120 mph. and a range of 700 mi. Fabric wing covering of the old Ercoupe has been replaced with metal. Forney is building its own VHF radio transmitter and receiver equipment, to be installed in the glove compartment area.

PRIVATE LINES

Passenger transport version of the Fletcher FU-24 agricultural airplane carries four persons in addition to the pilot in space usually occupied by the chemical hopper. If the seats are removed, up to 1,500 lb. of cargo can be carried.

An Alabama aeronautical chart, consolidating the segments of Birmingham, Mobile and Chattanooga sectionals, is being prepared by the Alabama Department of Aeronautics, Montgomery. To appear in six colors, it will be on World Aeronautical Chart scale.

Annual spring seminar for corporation pilots will be held Apr. 20-21 at the University Club, N. Y. C., by Executive Air Transport Co., Inc., P. O. Box 173, Smithtown, N. Y. Subjects will include: meteorology, airborne radar, air traffic control, instrumentation and procedures. Cost per person is $80.

Aerial survey covering 225,000 acres along the Caroni River has been awarded Photographic Survey Corp., Toronto, Canada, by Venezuela. . . . Another member of Hunting Associates, Ltd., Aeromagnetic Surveys, Ltd., has opened a new research and development laboratory at Oshawa Airport, near Toronto, for new airborne geophysics equipment.

Ontario Paper Co., Thorold, Ont., has purchased a Remmert-Werner-converted Douglas DC-3 with P&W Super-92 engines for transport of executives, engineers and technicians.

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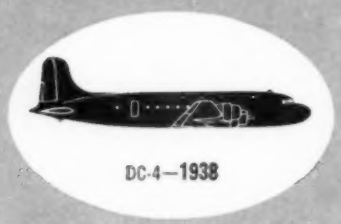
DC-3—**1935**



DC-4—**1938**

A-20 Havoc—**1939**

XB-19 Flying Laboratory
1941

A-26 Invader—**1942**

AD Skyraider—**1944**

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20 years of smooth flying for Douglas

C-124 Globemaster II
1947

DC-6—**1947**

DC-7—**1953**

Also Lord-equipped were:

B-23—1937; A-24, SBD—1941
C-53, C-47, R4D—1942; C-54, R5D—1942
Super DC-3—1949; DC-6A, DC-6B,
C-118, R6D—1952; DC-7C—1956

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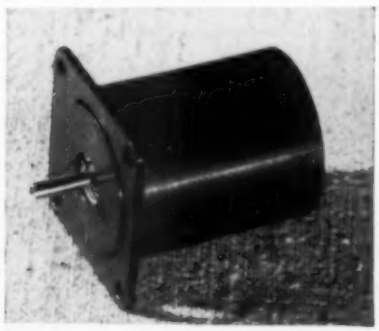
NEW AVIATION PRODUCTS

Mobile Starter for Jets

Trailer-mounted ASC-1 jet and turboprop engine starter provides 210 lb./min. weight flow of air at 60 psia., and is stated to exceed the requirements for the Allison J71 and P&W T34-P3 powerplants. Engines starts were made on the J71 in less than one minute with the unit. It is air transportable.

Gremco, Inc., 3535 No. Sylvania, Ft. Worth, Tex.



Hysteresis Synchronous Motors

A new line of hysteresis synchronous motors available in 8,000, 12,000, or 24,000-rpm. speeds is adaptable for single, two or three-phase supply with suitable phasing capacitors in the circuit.

J. B. Rea, 1723 Cloverfield Blvd., Santa Monica, Calif.

Dual-Element Lube Pump

Cartridge-mounted dual-element lube pump for gas turbine engines is built for use with petroleum-base engine oil or jet lubricating oil MIL-L-7808. Its capacity is 5 gpm. at 30 psi. gage and 3,600 rpm. Rated capacity is based on pumping SAE 10 lubricating oil at 275 F. Nominal input is 0.25 hp.

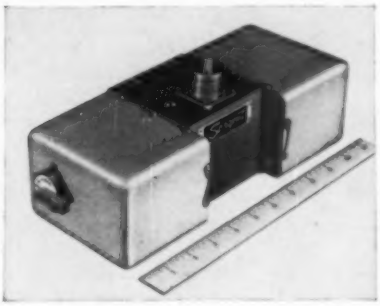
Pump contains no valves or shaft seals, O-rings or packings. Service is based on 1,000 hr. of trouble-free operation.

Lear, Inc., Lear-Romec Division, Elyria, Ohio.

Valve for Missile Launching

Heavy-duty two-position solenoid-controlled hydraulic valve for use in missile launching systems operates on 95-v. to 125-v. 60-cycle single-phase a.c. Equipped with moisture-proof housings, it can be left continuously energized in 165F ambient temperature. Shaded poles reduce a.c. hum.

Valve has no reciprocating components and will not respond to high-



impact shock. It has passed the MIL-S-901 H.I. shock test.

Unit operates in –20F to 165F in 1,500 or 3,000-psi. hydraulic systems. Capacity is 1.5 gpm. at 200 psi. total pressure drop. Maximum total internal leakage is 8 cc./min. at 1,500 psi.

Sargent Engineering Corp., 2533 E. 56th St., Huntington Park, Calif.

Pressure Control Panel

For remote control and sensing of operation of radar air pressurizing equipment in aircraft, a dual control panel can be used with Model RR-15020-A dual pressurizing unit.

Panel consists of air pressure gages,

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THE *NEW* ARTOS AUTOMATIC wire-stripping and TERMINAL-ATTACHING MACHINE

Artos TA-20-S with guard raised

Some examples of terminals attached by Artos Machine

This new Artos TA-20-S brings still greater speed and production economy to large-quantity users of wire leads with terminals attached. It *automatically* performs the following services *all in one operation:*

1. **Measures and cuts wire to predetermined lengths.**
2. **Strips one or both ends of wire.**
3. **Attaches practically any prefabricated terminal in strip form, to one end of wire.**
4. **Marks finished wire leads with code numbers and letters. (Optional attachment not standard part of machine.)**

ALL OPERATIONS ARE AUTOMATIC. Machine can be operated by unskilled labor. It is easily set up and adjusted for different lengths of wire and stripping. Die units for different type terminals simply and quickly changed. Production speeds up to 3,000 finished pieces per hour.

ARTOS MACHINES ARE USED by electric appliance, automotive, aircraft, electronics and other industries that want automation in the production of wire leads in quantity. Agents throughout the world.

Engineering consultation and recommendations given without obligation.

WRITE FOR BULLETIN ▶ No. 655 on the Artos TA-20-S

ARTOS ENGINEERING CO.

2773 South 28th Street Milwaukee 46, Wisconsin

electrical switches and two panels, one for high and one for low pressure systems. Toggle switches over-ride the pressure switches in the Model RR-15020-A so that the set can be checked on the ground for leakage.

Lear-Romec Division, Lear, Inc., Elyria, Ohio.

Tiny Blower Gives 60 Cfm

Axial-flow blower, using miniature motor, has a 2.2-in.-diameter body 3-in. long and produces 60 cfm. of free air. Impeller design incorporates a nose spinner to reduce noise and increase airflow. Units are available with radio noise filters.

Motronics Corp., 241 Concord St., Glendale, Calif.

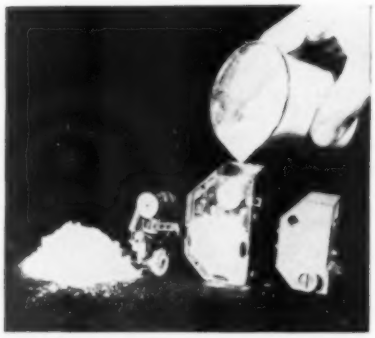
ALSO ON THE MARKET

Glass yarn, with Teflon coating applied to glass before braiding, for aircraft cables is inert to solvents and corrosive chemicals. Nominal ignition loss is 12%.—L. O. F. Glass Fibers Co., 1810 Madison Ave., Toledo 1, Ohio.

Radiacmeter IM-93 (pocket-type dosimeter), simple gamma-radiation detector, will measure up to 600 roentgens of gamma radiation. Easy-to-read scale reveals total radiation to which a body has been exposed over a given period of time. Device can be stored indefinitely. —Bendix Aviation Corp., Cincinnati Division, 203 W. Third St., Cincinnati, Ohio.

Polyester glass insulating (Pegi) conduit bushings are available for all conduit sizes. Units show a dielectric of 390 v. per mil, and are self-extinguishing after being exposed to flame.—Adalet Manufacturing Co., Cleveland 11, Ohio.

Eccofoam GL foam-in-place plastic powder is designed for filling structural cavities. It can be cured to a low-density foam which can be used up to 347F. Properties of the material at 20 lb./cu. ft. density: Dielectric constant



at 10^{10} cps., 1.48; dissipation factor at 10^{10} cps., 0.009; compressive strength, 600 psi.—Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.

Compact aircraft vacuum cleaner is designed to pick up ferrous and nonferrous metal chips and bolts up to ¾-in. diameter. Unit operates on 90 lb. air pressure.—Aircraft Tools, Inc., 9030 Bellanca Ave., Los Angeles 45, Calif.

Automatic embossing machine automatically attaches tying wires to metal tags at the rate of 75 per minute while embossing fixed and variable data.—Dashew Business Machines, Inc., 5886 Smiley Drive, Culver City, Calif.

Completely synthetic hose, used in keeping jet engines heated, handles air continuously at temperatures to 400F and working pressures of 100 psi. It can be made with inside diameters from ¾-in. to five inches and lengths up to 50 ft.—Quaker Rubber Div., H. K. Porter Co., Inc., Philadelphia, Pa.

PHI multi press, for aircraft manufacturers handling molding and forming of honeycomb and other new materials, has molding area of 54x110 in. and total pressure of 560 tons. Press has maximum opening of 18 in.—Pasadena Hydraulics, Inc., 279 N. Hill Ave., Pasadena 4, Calif.

JET BLAST DEFLECTOR developed by Boeing has been turned over to Blackstone Manufacturing Co., Inc., Chicago, Ill., as exclusive licensee. Unit has vanes that turn exhaust 90 deg. upwards to protect persons and property behind jet aircraft being run up on the ground.

Four-digit digital voltmeter automatically measures a.c. and d.c. voltages with an accuracy of 0.1% of full scale and ±1 digit respectively. Range is 0.001 to 999.9 volts. Frequency response is from 30-10,000 cycles at 10 megohms, 20 micro-cirofarads. Unit is designed for mounting in a standard 19-in. rack.—Electroc Instruments, Inc., 3794 Rosecrans St., San Diego 10, Calif.

Magnetic alloy additives, called Magnaloy, are applied with d.c. welder wire feeder and magnetic hopper combination. They are deposited at 20-40 lb./hr. Magnaloy HF 50 has hardness ranging from Rc48 to Rc53; HF40 ranges from Rc38 to Rc43; WH ranges from Rc20 to Rc45; BU from Rc29 to Rc33.—Western Carbide Corp., 6840 Vineland Ave., No. Hollywood, Calif.

Multi-synchronous, data-recording Syn-Cameras provide automatic, matched-frame analysis; photograph motions taking place simultaneously at separated locations. Control system eliminates the need for mechanical connections from camera to camera. Available in 16 mm. and 35 mm.—Flight Research, Inc., Richmond, Va.

Self-locking fastener attaches wire bundles, plumbing lines, insulation blankets,

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Typical of the advanced research and development projects currently being carried out successfully by Kaman Aircraft is this drone helicopter. The technical problems of remote control are more complex with a helicopter than with fixed-wing aircraft because of the 'copter's ability to fly in every direction at varying speeds, as well as to hover in flight. Kaman engineers solved these complicated problems by designing an entirely new electronic control system, miniature mechanical system and small automatic pilot. Kaman is proud that most of its 10 years have been devoted to the National Defense effort to keep the free world free.
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heater ducts, instruments, etc. Made under license with Boeing Airplane Co., item is used on KC-135 jet tanker. Two types: a forging for single-ended mounting; extrusion form for double-ended mounting.—Western Sky Industries, P. O. Box 300, Hayward, Calif.

Portable cable swager can handle ball-end terminals such as AN 663 up to $\frac{3}{16}$-in. cable size and sleeve-type terminals through $\frac{1}{4}$ in. Tool weighs about

12 lb. and operates on 90 lb. of air pressure.—Aircraft Tools, Inc., 9030 Bellanca Ave., Los Angeles 45, Calif.

Miniature power-type voltage reference is designed to replace chemical cells and VR tubes. Line voltage variations are 35-135 v. Units measure $3\frac{1}{16}$x$3\frac{1}{16}$x$4\frac{7}{8}$ in. They draw 25 v.a. from a 400-cycle source and are available in output voltages up to 20 v. d.c. and in output currents up to 1,000 m.a.—Timely Instruments & Controls Corp., 1645 W. 135th St., Gardena, Calif.

DPE, rack-and-panel type connector is made up of 40 contacts and is narrow for crowded installations. Flashover is rated at 1,700 v., 60 cps., a.c. rms at sea level. Weight of the mated connector is 0.381 lb. Complete nomenclature: DPE-40-34P for the plug with pins and DPE-40-33S for the mating socket side.—Cannon Electric Co., 3209 Humboldt St., Los Angeles 31, Calif.

V-lock vibration-resistant Teenuts incorporate V-type notch with circumference of the barrel compressed inwardly towards the axis to form a permanent set. Item is a one-piece, self-contained unit; may also be used as a stop nut.—Carr Fastener Co., Division of United-Carr Fastener Corp., Cambridge 42, Mass.

Series D precision force indicators have capacities of 50, 75, 100, 150 and 200 lb., capable of measuring all forces up to their maximum capacities with accuracies of $\frac{1}{2}$ lb. for 50 lb. model, $\frac{1}{4}$ lb. for 75 and 100 lb. models, 1 lb. for 150 and 200 lb. models. Individually calibrated, direct-reading dials have 100 divisions.—Engineering Dept., Hunter Spring Co., Lansdale, Pa.

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WHAT'S NEW

Telling the Market

Summary of an experiment determining **convective heat transfer on a supersonic airframe** through use of a V-2 rocket in flight, Bulletin 55SD3, General Electric Co., Special Defense Projects Department, 2900 Campbell Ave., Schenectady 6, N. Y. . . . Twelve types of **batteries for all categories of military and civil aircraft,** eight-page catalog Form 5773, punched for binder insertion, Electric Storage Battery Co., Box 8109, Philadelphia 1, Pa.

Bendix low-range fuel flow meter for light twin-engine planes, illustrated brochure, Airwork Corp., Millville, N. J. . . . **Liquidometer capacitor-type fuel gaging systems,** Bulletin 546, Liquidometer Corp., Dept. S, Skillman Ave. & 36th St., Long Island City 1, N. Y. . . . **Electrolytic shaping of honeycomb structures** to produce clean, sharp cell edges for optimum skin bonding, Bulletin 156, Anocut Engineering Co., 631 W. Washington St., Chicago 6, Ill.

Model 500 16-mm. highspeed motion picture camera for research and test recording, catalog, Traid Corp., Sherman Oaks, Calif. . . . **Unipunch two-piece**

A letter from Daddy
TO: JOAN REED

Dear Joanie:

Congratulations from the proudest papa on earth! So at last you're on the stage, treading the boards in the paths of other Great Ladies of the Legitimate Theater, like Cornell, Hayes, and Barrymore! Remember now, honey, on opening night just forget yourself completely, smooth out your costume, and let the character you portray come shining through.

Since you're going to be famous, you may not be interested in news about your daddy and his business flyin' machine—like, for instance, Southwest Airmotive's new pocket-size "program" detailing flat labor rates for the overhaul of engines, accessories, and instruments. As a kind of bonus for us old geezers, it even includes photos of SAC's beautiful ad models—which reminds me, I'm glad you're not the cheesecake type, even if you are 22, 5'6", 118 lbs., blue-eyed and blonde. For nearly a quarter-century, Southwest has pioneered many great things—including flat labor rates—and this little SAC booklet is a useful reminder that the company remains No. 1 in top-quality craftsmanship at money-saving prices. They'll send a copy to any pilot or owner on request, and I'll have 'em mail one to you just for fun.

Good luck—and remember grandpa and grandma were in the theater, too. Only one Black Sheep—your Uncle Hugo who was in burlesque, but we don't mention him!

Love,

Daddy

SOUTHWEST AIRMOTIVE CO. • LOVE FIELD • DALLAS, TEXAS

perforating units for press and press brake setups, catalog, Punch Products Corp., 3800 Highland Ave., Niagara Falls, N. Y. . . . **Background information on titanium** and company production facilities, in the Story of Titanium, Mallory-Sharon Titanium Corp., Niles, Ohio.

Availability and cost of aircraft and crews for **flight testing new aviation products,** brochure, Equipment Flight Test Division, Meteor Air Transport, Teterboro Airport, Teterboro, N. J. . . . A design for **non-sticking plug and ring gages and locators,** Bulletin 433, price 45 cents, University of Illinois Engineering Experiment Station, Urbana, Ill.

Facilities for producing AN and special hose and cable assemblies in addition to hardware machining to specification are described in publication available from Durham Aircraft Service, Inc., 56-15 Northern Boulevard, Woodside 77, N. Y. . . . **Air, Sea Survival Equipment,** 36-page catalog and instruction manual; write on letterhead to Switlik Parachute Co., 1325 E. State St., Trenton, N. J. . . . **Explosive valve** line, Catalog 5501-XV, Conax Corp., Explosive Products Division, Buffalo 21, N. Y.

Publications Received

• **General Billy Mitchell, Champion of Air Defense**—by Roger Burlingame—Pub. by Signet Books, New American Library, 501 Madison Ave., New York 22, N. Y. 10 plates. (reprint of original hardcover edition pub. by McGraw-Hill Book Co.)

A biography of General Mitchell.

• **Man and the Winds**—by E. Aubert de la Rue, translated by Madge E. Thompson—Pub. by Philosophical Library, 15 E. 40th Street, New York 16, N. Y. 12 plates. $6.00.

The winds as they affect different spheres of human activity. Includes one chapter on "The Wind and Aviation."

• **Aircraft Badges and Markings**—by Harold B. Pereira, with a foreword by Lord Douglas of Kirtleside—Pub. by John de Graff, Inc., 64 W. 23rd St., New York 10, N. Y. $1.50.

A pocket-sized book, containing colored reproductions of national markings, fin flashes, and world-wide airline badges.

• **Solid Propellant Rockets, an Introductory Handbook**—by Alfred J. Zachringer, B. Sc.—Pub. by and available only through American Rocket Co., Box 1112, Wyandotte, Mich.

A general introduction to the field of solid propellant rockets.

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Stress Engineers for both Sheet Metal Structures and Mechanical Systems
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Delta Favored for N.Y.-Florida Route

CAB examiner picks carrier to compete with Eastern, National; recommends route changes, investigation.

By Craig Lewis

Washington—Delta Air Lines has been chosen to compete with Eastern Air Lines and National Airlines for traffic between the Northeast and Florida by Civil Aeronautics Board Examiner Thomas L. Wrenn in his report on the New York-Florida case.

Wrenn's report brings the proceeding—the fourth in a recent series of major route cases—into its final phase. He found ample evidence of the need for a third carrier on the East Coast route, and found Delta the most logical candidate.

The report also recommends route adjustments for five other carriers (see box, p. 97) which would stiffen competition all along the East Coast and especially in the area between Washington and Boston.

Examiner's Reasoning

Wrenn turned down the application of Northeast Airlines, a leading contender for the N. Y.-Miami route, and suggested that a CAB investigation of the control relationship between Northeast and the Atlas Corporation might be in the public interest.

Calling the East Coast route the foremost air travel route in the country, Wrenn found sufficient traffic and prospects for growth to support competition from a third airline. He credited Eastern and National with doing an excellent job of promoting and serving the route, but pointed out that the Board has provided three or more carriers for service on much smaller routes.

Wrenn found that Eastern's position is strong enough to stand competition from a third carrier. National's substantial dependence on the route is a greater consideration, but Wrenn concluded that traffic is heavy enough to enable National to survive new competition.

The examiner criticized both Eastern and National for neglecting other potentially lucrative routes in their intense competition for N. Y.-Miami traffic. In recommending added competition, he found that one more airline would be enough on the route now.

Delta Air Lines is the most logical choice for the route for a number of reasons, Wrenn said. He pointed out that Delta already serves nearly all of the cities involved and needs only a short gap filled to complete the route, while certification of any other carrier would require an extension of at least 700 miles into new territory.

The fact that Delta proposes to operate DC-7s on the route and has ordered turbojet equipment is another point in its favor, Wrenn said. He said Delta's equipment will be very similar to that operated by Eastern and National on the highly competitive route.

Another reason for choosing Delta was that, in the examiner's view, Delta offers less diversionary effect on National than Capital Airlines and Pan American World Airways, other major contenders for the route.

When Delta presented its side in the N. Y.-Florida case hearings last summer, it estimated that 1956 traffic would be about 1.8 billion passenger-miles. Delta figured it would get about 26% of the market if it operated between N. Y. and Florida this year.

Investment in new aircraft and facilities necessary to operate the route was estimated last summer at $28,471,750. Delta thought 22 new aircraft would be needed, including nine Convair 340s, eight DC-6s and five DC-7s.

National's Changes

Route adjustments recommended for National would extend its Miami-New York route to Boston and allow it to operate shuttle service in the markets between Washington, New York and Boston.

The extension of National to Boston is favored by Wrenn as a means of supplying Boston with a competitive service to Florida and its first single carrier service to Norfolk. The same services would be available to Providence and Hartford/Springfield.

Service to Norfolk would be further improved with the removal of restrictions against National's serving Washington or Baltimore and Norfolk on the same flight. Wrenn would restrict National from serving Richmond and Norfolk on the same flight, in order to protect Piedmont Airlines in that market.

Wrenn also recommends removal of a restriction which says that National flights serving Richmond, Washington or Baltimore must originate or terminate at Charlotte or a point to the south. The effect of lifting this restriction would be to allow National to operate turn-around service on New York-Washington and New York-Boston routes, both of which are among the five leading air travel markets in the nation.

ROUTE CHANGES recommended by examiner would improve East Coast service.

Removal of a third restriction would allow National to carry local passengers between Philadelphia and New York. Wrenn also recommends making National's authority to serve Newport News-Hampton-Warwick permanent.

Eastern's Service

Eastern Air Lines was not favored for any new routes, but Wrenn recommended lifting three restrictions on Eastern's operations, which would allow it to improve services.

Wrenn thinks Eastern's New England restriction should be lifted so that the carrier can operate locally between New York and Boston. Under the current restriction, Eastern can serve Boston only on flights originating or terminating south of Richmond or west of Charleston, W. Va.

Removal of another long-haul restriction would allow Eastern to operate turn-around service between Tampa and Miami instead of having to serve the points on flights to or from Atlanta or Birmingham.

Service to Tampa would also be im-

proved if the CAB accepted Wrenn's recommendation that Eastern's routes be changed so it can fly between Tampa and Washington and other northern points without stopping at Atlanta.

Capital, United, TWA

The examiner favors a change in Capital Airlines' routes so the airline would have a direct Norfolk/Newport News-Washington-Baltimore-Philadelphia-New York route. This would allow Capital to provide the Norfolk area with a competitive direct service to Philadelphia or New York.

The short route extensions recommended for United Air Lines and Trans World Airline would close gaps between the eastern terminals of the carriers' transcontinental routes. All the new route segments would be subject to long-haul restrictions, precluding shuttle service by either carrier in the new markets between Washington and Boston.

The extensions Wrenn favors for TWA and United would allow them to serve more than one major eastern terminal on flights to the West. Service to Boston and Washington could be improved if New York could be served on the same flight, since the New York market could provide support for new services at other eastern points.

Wrenn found various reasons for rejecting the application of the other three major contenders for the N. Y.-Florida route—Pan American, Northeast and Capital.

Pan American Rejected

Wrenn found that certification of Pan American for the domestic route would have a serious effect on National, since National carries a substantial amount of traffic to the North which Pan American brings to Miami. Countering Pan American's argument that it should have direct access to major U.S. traffic markets for its Latin American services, Wrenn pointed out that two interchanges now provide direct service to New York via Miami, and he questioned the propriety of extending Pan American's international routes in a case involving purely domestic routes.

The examiner rejected Northeast as a competitor on the East Coast route because he doesn't think Northeast would be strong enough to compete effectively. He pointed to Northeast's proposal to use DC-6Bs and its failure to develop into a strong contender in the New York-Boston market as indications that the New England airline probably wouldn't be able to meet the very stiff competitive requirements of the N.Y.-Florida market.

Wrenn also questioned the relationship between Northeast and the Atlas Corp., which controls Northeast. "The public interest is not served by the issuance of route certificates where, as seems certain here, the certificate will be a spawn of speculative capital," Wrenn said.

He suggested an investigation of the relationships between the airline, Atlas and various other organizations.

Capital is not favored for the route because Wrenn thinks its certification would result in greater diversion from National than would certification of Delta. Wrenn also questioned the capabilities of Capital's Viscount transport on the long-haul N.Y.-Florida route, compared with the faster, longer range DC-7.

Wrenn also turned down applications for the East Coast route filed by North American Airlines, Resort Airlines and Riddle Airlines.

Who Would Get What

CAB Examiner Thomas L. Wrenn advised the Board to grant these routes in the New York-Florida Service Case:

- **Delta Air Lines: A route between Miami and New York/Newark via Tampa, Jacksonville, Brunswick, Savannah, Augusta, Columbia, Charlotte, Fayetteville, Greensboro-High Point/Winston-Salem, Washington, Baltimore, and Philadelphia.**
- **National Airlines: Extension of its Miami-New York route to Boston via Hartford/Springfield and Providence. Removal of restrictions against carrying local traffic between Philadelphia and New York/Newark and against serving Norfolk and Washington and Baltimore on the same flight. Removal of the restriction that flights serving Richmond, Washington or Baltimore originate or terminate at Charleston or a point to the south. Temporary authority to serve Newport News-Hampton-Warwick be made permanent with a restriction against serving these points and Richmond on the same flight.**
- **Capital Airlines: Extension of its Route 51 from Norfolk and Newport News to Washington, Baltimore, Philadelphia and New York/Newark.**
- **Trans World Airlines: Extension of its Dayton-New York/Newark route to Boston via Hartford/Springfield and extension of its Dayton-Washington/Baltimore route to Philadelphia and New York/Newark with both extensions subject to long-haul restrictions.**
- **United Air Lines: Extension of its Toledo-Washington/Baltimore route to Philadelphia and New York/Newark and extension of its Toledo-New York/Newark route to Boston via Hartford/Springfield with both extensions subject to long-haul restrictions.**
- **Eastern Air Lines: Removal of the New England restriction and the restriction requiring Miami-Tampa flights to originate or terminate at Atlanta or Birmingham. Authority to operate nonstop between Tampa and Washington and points north without a compulsory stop at Atlanta.**

Control of Outer Space

The problem of who controls outer space will be taken up by the International Civil Aviation Organization at its June meeting in Caracas.

A report to be put before the ICAO Assembly points out that "mechanical contrivances" will probably invade outer space in the near future and none of the legal rules on sovereignty apply to this area. Present rules give nations sovereignty over airspace above their territory, but they don't mention whether it goes beyond the atmosphere. The ICAO report says the organization is interested in the matter because anything that is going to fly around in outer space has to pass through someone's airspace to get there.

Northwest Orders New Univac System

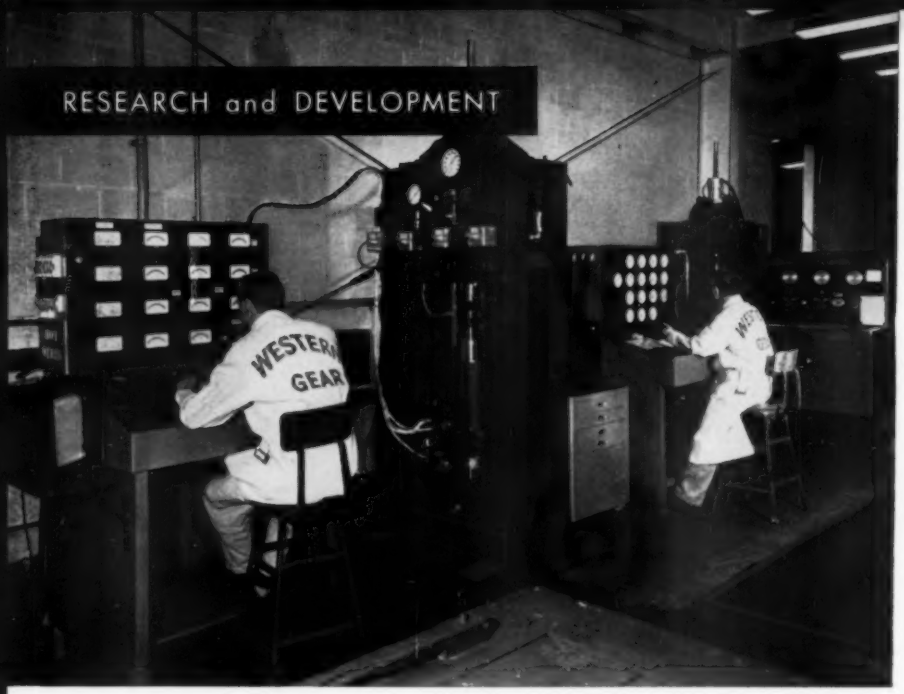
Northwest Orient Airlines last week ordered a reservation control system from the Remington Rand Univac Division of Sperry-Rand Corp.

The airline plans to install the system in a headquarters operational base scheduled for early construction at Minneapolis.

Northwest is the first customer for the Univac Airlines Reservations system. Five airlines are using, or have ordered, "datamation" devices manufactured by the Teleregister Corp. (AW Mar. 19, p. 65) for reservation operations.

The new system will combine a centrally located master unit linked to small "agent" sets at reservations and ticket offices. Northwest plans to eventually use the system throughout its entire network.

Besides controlling reservations, the Univac computer unit will be used by Northwest for a number of other airline chores, including the production of many kinds of sales information.



The Role of Modern Test Facilities in the Design of Aircraft Gear Drives

by John Morris

Manager of Engineering, Western Gear Corporation

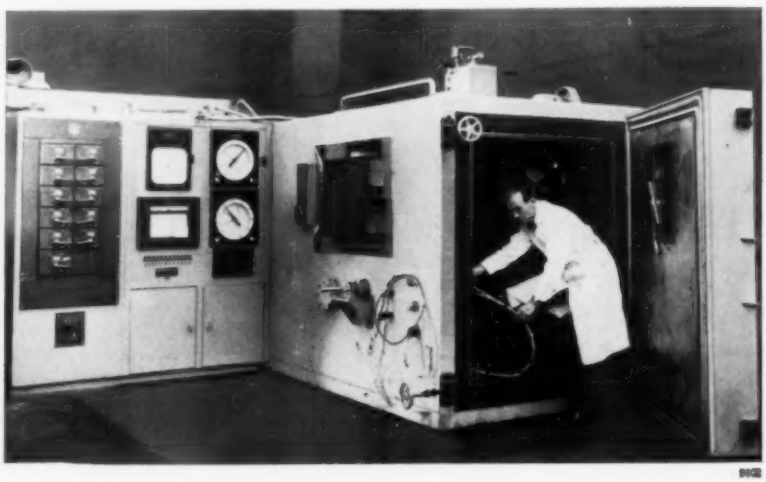
Modern aircraft, whether it be piloted or electronically guided, requires mechanical devices of utmost reliability. No longer can the designer depend entirely upon experience but must have available extensive equipment capable of producing the environments and loading conditions which will check the newly designed parts to the conditions encountered on its assigned mission.

This environmental test equipment must be operated by experienced personnel under the guidance of engineers capable of correlating and analyzing test results and their actual relation to final installations before a suitable product can be designed, produced, and proven. Mother Nature in her unlimited weather laboratory produces extreme variations of the elements in almost incalculable combinations. The laboratory must endeavor to precisely duplicate conditions. Altitude chambers at Western Gear Corporation (as shown in the photo at lower right) can carry the test part to the extremes of altitude beyond the reaches of piloted flight up to and in excess of 90,000 ft. Temperatures must be duplicated far below those normally encountered by present day military craft. Tests have been run at Western Gear as low as –300° F.

The salt spray of the sea and the steaming humidity of the jungle as well as the wind and dust of the desert are being duplicated daily in our block-long test laboratory. The tremendous speeds as well as the necessity for the utmost in control produce forces in any direction which are simulated in Western Gear centrifuges in excess of 100 times the normal weight of the part. Studies of the reaction to shock loadings are duplicated in our laboratory by impact tests often running in excess of 200 G's.

The effects of wind, sand, dust, rain, sunshine, snow, heat, cold, vibration, impact, chemicals, lubricants and materials must be evaluated while constantly striving to increase load carrying ability, serviceability and reliability of products. Extensive testing is required to assure that no possible condition has been overlooked which may cause a malfunction. An example of a test stand setup to check the operational characteristics for testing linear actuators is shown at upper left. The interrelation of magnetism, electricity, gravity, vibrations, forces, materials and chemicals under environmental conditions often poses the necessity of multitudes of carefully controlled, precisely measured tests.

Western Gear engineering recognizes these very necessary elements. Therefore, in our block-long testing laboratory the most modern equipment is provided to prove design concepts. Thus meticulous attention to perfection has made Western Gear the leader in the field of aircraft gearing and systems design. Why not let us assist you in your next power transmission problem? Western Gear Corporation, General Offices, P.O. Box 182, Lynwood, California.



Convair Jet Has Transcontinental Potential

By Richard Sweeney

San Diego, Calif.—Convair's medium-range Model 22 jet transport, the Skylark 600, will have a guaranteed maximum landing roll of 5,000 ft. and, as an unplanned bonus feature, will be capable of nonstop flights between New York and Los Angeles.

Convair has not yet received written Air Force permission to use the General Electric J79 turbojet engine, four of which power the 580 mph. cruise-speed Skylark, but verbal approval has been given by USAF officials for the Skylark. The J79 will have 10,000 lb. dry static thrust. (For earlier Convair jet design, see AW Aug. 22, p. 17.)

Other details of the Skylark, which have turned the airlines' present new equipment picture into a kaleidoscope of uncertainty:

- **A 2,000 sq.-ft. wing area,** basis of the new transport's landing roll guarantee.
- **Landing roll guarantee does not** include use of thrust reversers or boundary layer control.
- **Although billed** as a medium-range (1,500-2,000 mi). transport, the size of the Skylark's low wing yields sufficient fuel-tankage space for the east-to-west transcontinental flight.
- **Wing loading** will be 70-to-80 lb. per sq. ft.
- **Break-even distance** is said to be 300 mi. but probably will be nearer 250 mi. after final design changes.
- **Break-even load factor** (passengers, mail, cargo) will be 65% of aircraft's capacity.
- **Takeoff distance** (to clear a 50-ft. object) will be 6,700 ft. at maximum gross takeoff weight of 170,000 lb. for transcontinental nonstop flights. Medium-range flight gross takeoff weight is predicted at about 152,000 lb.
- **Landing roll** stays at 5,000 ft. until past the 1,750 mi. point when takeoff is at maximum gross weight.

SKYLARK THREE-VIEW shows standard jet transport configuration with swept surfaces.

Hughes Has First Choice

Howard Hughes is understood to have first chance at the Skylark 600. The transport has not as yet been presented to airlines which already have ordered turboprops.

United Air Lines also is interested in the medium-range transport, as is Delta Air Lines and Eastern, although the latter already has ordered turboprop Lockheed Electras (AW Oct. 3, p. 95).

Deliveries of the $3.5 million each plane will start in 1960. The aircraft will carry 80 first class or 99 coach passengers and a crew that will consist of two pilots, flight engineer and two stewardesses.

Wing span will be 118 ft., 4 in.; length, 118 ft., 5 in. The top of the vertical stabilizer will be 35 ft., 2 in. above the ground. Fore and aft passenger entrances will be provided.

The landing gear will have two wheels on the nose gear and four on each main strut. The latter will fully retract into the wing's very thick root.

Douglas, Boeing Follow Suit

News of the Convair jet was followed closely by proposals of similar planes by Boeing, Douglas and Lockheed. But these were built around the Pratt & Whitney J52 engine. None of the three announced any details of their proposed planes.

Other aspects of the Convair's appearance in the jet picture:

- **Airlines that have ordered** 450-mph. turboprops for 1960 wondered about flying them over routes where their competitors will be operating Convair jets.
- **The unexpected bonus** of transcontinental capability put airlines that have not bought Douglas or Boeings into the position of being able to buy transcontinental jets tailor-made for short and medium-range operations in and out of present airports.
- **The 5,000-ft.** guaranteed landing roll insured jet service for many cities without their having to spend large sums to expand airport runways.
- **The Convair** will be able to operate on many European routes where airports cannot be expanded to accommodate the longer landing roll of Douglas and Boeing jets.
- **If Convair adds thrust reversers** and boundary layer control, the plane's even greater capability will again upset the transport applecart.

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Airlines Report Big Increases In Traffic, Revenues for 1955

Airline annual reports for 1955 show substantial increases in traffic and revenues and impressive gains in income.

Reports from Eastern Air Lines, Trans World Airlines, Western Air Lines, Northeast Airlines, North Central Airlines and Seaboard and Western Airlines show that all but TWA had a substantial increase in net income for the year.

Eastern Air Lines

Eastern's revenues totaled $203,893,076 last year, compared with $169,913,165 in 1954. Net income was $13,309,497, nearly double the 1954 figure of $7,152,012. The 1955 income includes a profit of $3,342,791 from the sale of old equipment.

During the year, Eastern carried 6,728,237 passengers 3,695,517,468 passenger-miles. Load factor was 61.08%. In 1954, the airline carried 5,783,980 passengers and flew 3,142,818,051 passenger-miles with a load factor computed at 57.97%.

Freight carried totaled 30,016,208 pounds in 1955, and 31,016,481 pounds of mail were flown last year.

Trans World Airlines

TWA carried 4,048,000 passengers last year compared with 3,594,000 in the previous year. Passenger-miles totaled 3,502,931,000 in 1955 and 3,212,629,000 in 1954.

Freight and express traffic was 41,253,000 ton-miles and mail 23,677,000 ton-miles last year. The 1955 passenger load factor was 64.8% compared with 67.4% in 1954.

Total revenues were $217,431,000, compared with $203,671,000 for the preceding year.

TWA's profit dropped nearly 50% from $10,336,000 in 1954 to $5,407,000 last year.

The airline attributes this to a sizable decline in mail revenue, the loss of two Martin transports and costs involved in introduction of the Super-G Constellation.

North Central Airlines

North Central reports record passenger revenues of $4,933,487 last year, a substantial increase over 1954 revenues of $3,351,782. A decline in mail revenue produced a smaller increase in total revenues, with 1955 totaling $6,809,041 and 1954 revenues $5,824,042. Net profit for the year was $128,449 compared with $111,707 for the previous year. The profit reduced North Central's deficit from $208,806 to $80,357.

North Central said it is now the leading local airline in terms of passengers, mail and express carried. Last year it flew 430,445 passengers, 52% more than in the previous year. Air mail volume was up 15% and air express gained 53%. Surface mail traffic increased 18%.

Western Air Lines

Western's total revenues increased from $24,480,779 in 1954 to $31,039,523 last year. Net income went from $1,458,699 in 1954 to $1,981,685 in 1955.

Dividends paid during the year totaled 90 cents a share.

Western carried a million passengers for the first time last year, with the 1955 total reaching 1,092,578, compared to 834,910 in 1954. Passenger-miles increased from 402,255,000 in 1954 to 514,677,000 last year. The 1955 passenger load factor was 59.1%, compared with 55.7% in the previous year.

Northeast Airlines

Northeast increased traffic 11.7% to 116,450,932 passenger-miles last year. The system load factor was 59.22% in 1955 and 55.91% in 1954.

Northeast's total revenues were up from $9,451,204 in 1954 to $10,120,300 in the past year.

Operating profit was $148,387, down slightly from $169,924 in 1954. Northeast registered a gain of $377,217 from sale of aircraft which increased its net profit after taxes to $379,937 for 1955, compared with $138,112 for the previous year.

The airline attributes the drop in operating profit to a reduction of more than $250,000 in subsidy. During the year credit arrangements were made to cover payments on a fleet of 10 DC-6B transports ordered from Douglas aircraft in January, 1955.

Seaboard & Western

Seaboard and Western, which will start operations as a scheduled carrier this month, flew 15,328,000 cargo ton-miles in 1955—27% more than the carrier flew in 1954.

Operating revenues were $18,479,768, nearly triple the 1954 revenues of $6,466,143.

Last year the airline's revenue included $5,689,974 from freight and $12,789,794 from other sources. Net income was $1,967,369 compared with a loss of $364,753 in the previous year of operation.

Seaboard attributes its increased earning power largely to the efficiency of its fleet of four Super Constellations which operated for the first full year in 1955.

The cargo airline has ordered six more Super Constellations for delivery in 1956 and 1957.

$500 Million Tax Aid Granted to Airlines

Washington—Aircraft expansion goals for rapid tax write-off have been filled with the approval of $500 million in rapid amortization certificates by the Office of Defense Mobilization. The certificates include 132 turboprop aircraft, but none of the turbojet transports ordered were on the list.

The certificates approved by ODM now cover a total of 900 aircraft. The original goal of 600 aircraft was extended 300 units last fall, and the extension now is filled.

In a separate action, the ODM reopened the expansion goal for airport facilities.

Applications received before Sept. 30, 1955 will now be considered for tax certificates.

When the 600 aircraft expansion goal was filled, industry groups asked the ODM to extend it (AW Aug. 29, 1955, p. 12).

Defense Air Transportation Administration, the agency which advises ODM on air transport matters, also recommended that the goal be extended, with an open-end limit. ODM finally decided on the 300 unit expansion.

Applications were processed in turn as they were filed, and the added 300 aircraft have been approved for rapid amortization. If turbojet transports are to have the benefits of rapid amortization, the goal will have to be extended again.

DATA currently is preparing a recommendation for ODM.

Terms of the certificates allow the airlines to write off 80% of the aircraft value in five years instead of the usual seven. Included in the approvals were:

- **Capital Airlines:** $64,175,000 for 60 Viscounts.
- **Delta Air Lines:** $24,750,000 for 11 DC-7s.
- **Eastern Air Lines:** $202,662,335 for 37 Lockheed Electras, 28 DC-7Bs and 10 Super-G Constellations. Three of Eastern's order of 40 Electras were excluded when the goal was filled.
- **United Air Lines:** $51,394,975 for 7 DC-6Bs and 19 DC-7s.
- **American Airlines:** $107,388,689 for 35 Electras, 9 DC-7s and 12 DC-6Bs.
- **Northwest Airlines:** $44,064,410 for 10 DC-6Bs and 8 DC-7Cs.
- **Western Air Lines:** $15,500,000 for 12 DC-6Bs.

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Airline Income and Expenses—January

(In Dollars)

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Subsidy	Total Operating Revenue	Total Operating Expense	Net Operating Income (before taxes)
DOMESTIC TRUNK								
American	18,810,704	513,735	366,618	1,072,782		21,014,960	18,791,624	2,223,336
Braniff	3,136,665	68,349	43,781	81,624		3,410,960	3,077,571	333,389
Capital	3,666,617	95,742	84,943	73,659		3,982,745	4,432,906	−450,161
Colonial	492,963	7,908	3,258	14,021	45,742	575,169	615,904	−40,735
Continental	1,227,896	31,751	10,723	32,446	117,018	1,446,276	1,381,328	64,948
Delta	4,792,291	105,157	83,694	140,261		5,268,627	4,482,419	786,208
Eastern	17,815,805	323,366	172,670	212,993		18,937,670	15,169,868	3,782,283
National	4,780,860	92,592	29,619	120,184		5,240,526	4,243,700	996,826
Northeast	437,420	8,254	6,465	9,952	182,236	654,492	786,162	−131,670
Northwest	3,418,172	114,962	77,686	140,588		3,835,036	4,063,369	−228,333
Trans World	11,835,765	342,578	272,458	407,090		13,082,815	12,954,677	128,138
United	16,364,437	723,918	381,043	640,754		18,253,184	17,521,978	731,206
Western	769,239	16,068	7,979	9,652		820,401	1,353,221	−532,819
INTERNATIONAL								
American	421,912	14,364	148	45,200		496,195	104,303	−782
Braniff	435,650	120,648		27,689		629,155	676,795	−17,639
Caribbean Atlantic	132,518	1,470		4,393		150,628	121,274	29,354
Colonial	60,049	315		1,267	4,585	68,692	111,546	−42,853
Delta	410,822	5,068		16,604		442,951	424,394	18,557
Eastern	1,069,702	26,123		15,813		1,134,982	712,351	423,499
National	419,103	2,924	1,487	6,432		447,501	274,559	173,367
Northwest	980,184	478,024	4,303	307,383		1,806,731	1,788,334	18,396
Pan American								
Alaska	243,000	12,000		49,000	122,000	441,000	615,000	−174,000
Atlantic	4,791,000	740,000		648,000	191,000	7,113,000	7,619,000	−506,000
Pacific	3,533,000	611,000		408,000	73,000	4,841,000	4,773,000	68,000
Latin America	5,130,000	247,000		791,000	530,000	7,115,000	6,792,000	323,000
Panagra	1,108,224	76,721		153,295	4,897	1,540,910	1,486,645	54,265
Trans World	2,285,408	523,270		238,305		3,293,651	4,907,103	−1,613,452
United	903,698	752,932		12,339		960,738	797,333	163,405
LOCAL SERVICE								
Allegheny	238,355	10,672	8,943	522	135,872	406,285	485,117	−78,832
Bonanza	116,587	2,756	1,520	2,695	83,625	210,636	245,658	−35,022
Central	68,480	3,062	1,049	2,403	178,079	255,396	255,762	−366
Frontier*								
Lake Central	86,566	2,791	4,814		116,561	211,216	227,214	−15,997
Mohawk	269,814	3,334	2,800	4,432	54,078	338,569	414,243	−75,674
North Central	408,064	15,237	12,862	144,935		585,259	578,470	6,789
Ozark	207,626	182,083	6,676			398,417	434,884	−36,467
Piedmont	323,445	7,864	4,198	4,474	167,523	516,117	578,289	−62,172
Southern	139,590	5,913	4,304		145,342	306,669	302,503	4,166
Southwest	220,329	7,209	3,284	5,299	81,028	328,359	373,977	−45,618
Trans Texas	197,832		3,847	5,922	210,217	428,904	436,044	−7,140
West Coast	145,848	3,513	2,170	2,301	125,132	283,102	326,949	−43,846
HAWAIIAN								
Hawaiian	295,897	2,601		48,984	21,097	354,302	416,470	−62,168
Trans Pacific	126,462	755		4,988	4,331	139,589	169,159	−29,569
CARGO LINES								
Aerovias Sud Americana				176,697		186,743	201,573	−14,829
Flying Tiger				678,637		665,904	1,106,306	−440,402
Slick				951,723		951,723	1,019,980	−68,257
Riddle		678	850	247,238		339,176	367,532	−28,356
HELICOPTER								
N. Y. Airways	16,371	2,718	2,926	2,215	119,842	144,931	129,590	15,340
Los Angeles Airways*								
Helicopter Air Service		38,645				39,672	39,560	82

* Not available.

Compiled by Aviation Week from airline reports to Civil Aeronautics Board.

APRIL 23rd AIR TRANSPORT Facts and Figures

(PUBLISHED BY THE AIR TRANSPORT ASSOCIATION)

AVIATION WEEK has been officially designated to resume the publication of "Air Transport Facts and Figures," published by the Air Transport Association. This editorial feature will appear in our April 23rd issue and will provide an impressive picture of the tremendous progress achieved by the carriers during the past year. A.T.A. is to be congratulated on making this vitally important editorial feature again available to AVIATION WEEK, thus insuring a vastly expanded audience and a world-wide impact.

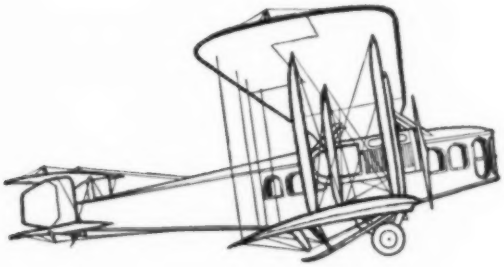
AVIATION WEEK average net paid ABC circulation June-December, 1955; **54,548**. Paid circulation of current issues; **57,300**. Recent readership research by Advertising Research Foundation shows 1.4 readers for every subscriber copy of AVIATION WEEK (readership determined by personal interview using strict recognition test). Current print order **60,670** copies.

Your advertising message scheduled for the April 23, 1956 issue will be timed to gain maximum attention from all those interested in the Air Transport industry. Regular advertising rates will apply.

AVIATION WEEK

A McGRAW-HILL PUBLICATION ABP ABC

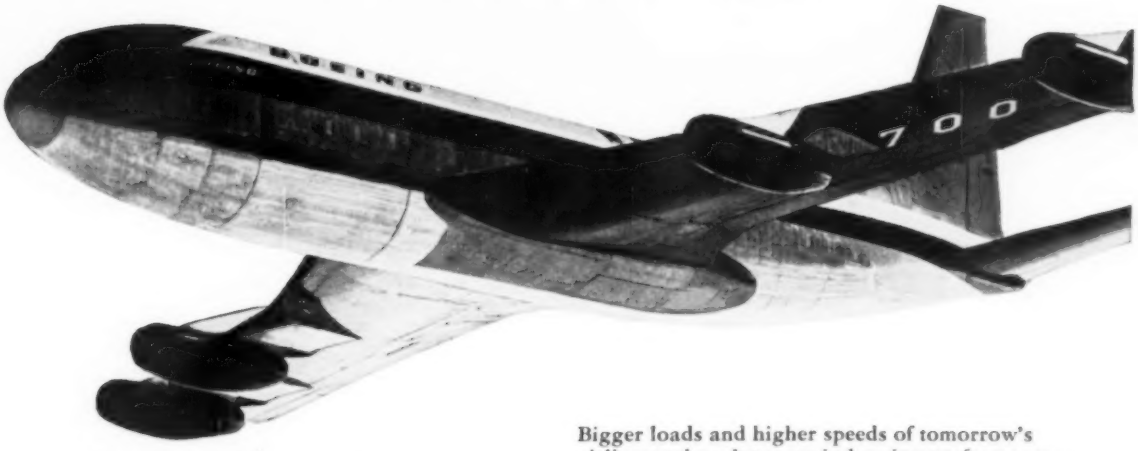
330 West 42nd Street, New York 36, N. Y.



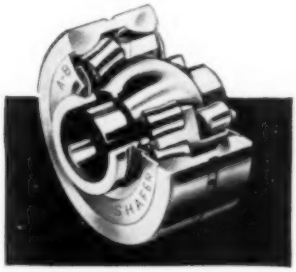
This Lawson airliner began service from Milwaukee to New York and Washington and return in 1920. It carried 20 passengers at an average speed of 110 m.p.h.

IN COMMERCIAL AIRLINERS...

it takes a lot more today



Today's new Boeing Jet Stratoliner will carry 130 passengers at speeds in the 555 m.p.h. range, making five-hour commercial coast-to-coast operations common.



Double row shown. Also, single row bearing, rod end and torque tube bearings. Design features 10° plus or minus self-alignment...easy relubrication without disassembly... exceptional shock-load reserve strength.

Bigger loads and higher speeds of tomorrow's airliners take a lot more in bearing performance—and Shafer Aircraft Bearings are providing it.

The three main reasons for Shafer being specified are:

1) Automatic self-alignment—*even under oscillatory loads.* Only Shafer offers this advantage that solves a severe problem in modern aircraft design.

2) Full capacity—*under combined loads.* Double row bearings carry any radial-thrust combinations on full contact area under any misalignment.

3) Relubrication—*without disassembly.* Lubricating groove allows burying Shafer in any member provided with lubricating fitting.

These and other specialized Shafer® Aircraft Bearing features save valuable engineering time...save space and weight in finalized design...and save time and expense in man-hours.

Why not see how they can save for you?

Write, wire or call: Shafer Aircraft Bearing Division, 801 Burlington Ave., Downers Grove, Ill. Meanwhile, write for new full-color catalog No. 54.

SHAFER BEARING DIVISION

CHAIN BELT COMPANY

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for MISSILE SYSTEMS

■ *New activities at Lockheed Missile Systems Division have created positions for Designers capable of performing* creative basic layout and design of structural, mechanical, electro-mechanical and electronic packaging of missile assemblies and components.

■ *Those who will qualify will cope with new problems in a field of scientific endeavor that grows daily in complexity.* A knowledge of new materials, finishes, specifications and experience on small precision devices will prove helpful in meeting the challenge of Missile Systems research and development.

Those possessing a high order of ability applicable to these areas of endeavor are invited to write:

VARIED ASSIGNMENTS

Designers are not limited to specific functions under Missile Systems Division's philosophy of operation. Diversified assignments provide stimulating challenge, enable Designers to acquire the broadest possible background in the field of missile systems design. For example: it is not uncommon for a Missile Systems Designer to work on diverse problems in structures, controls, hydraulics, pneumatics, electro-mechanical packaging, fuel systems and other fields within the span of a few months.

Lockheed **MISSILE SYSTEMS DIVISION**

research and engineering staff

LOCKHEED AIRCRAFT CORPORATION • VAN NUYS, CALIFORNIA

Airline Executives Report Pay, Bonuses, Compensation for 1955

Washington—Officers and directors of scheduled airlines filed the following reports with the Civil Aeronautics Board on salaries, bonuses and indirect compensation for 1955.

Aerovias Sud Americana, Inc. V. V. Carmichael Jr., president and director, $10,200 salary, $250 bonus and indirect compensation; Paul E. Dixon, Jr., vice president and director, $10,200 salary, $250 bonus and indirect compensation; David M. Benson, vice president, $10,200 salary, $250 bonus and indirect compensation; J. D. Rains, secretary-treasurer, $10,200 salary, $250 bonus and indirect compensation; C. Booker Powell, vice president, $7,750 salary (up $1,750), $100 bonus and indirect compensation; R. C. Minor, vice president, $7,500 salary (up $1,650), $150 bonus and indirect compensation; M. M. Landy, director, no salary and no bonus or indirect compensation; William R. Hough, director, no salary and no bonus or indirect compensation; and George Tomberlin, director, no salary and no bonus or indirect compensation.

The Flying Tiger Line, Inc. Robert W. Prescott, president and director, $38,030 salary (up $3,864) and no bonus or indirect; Samuel B. Mosher, chairman of board, no salary, $300 bonus and indirect (down $300); William E. Bartling, vice president, $14,400 salary (up $2,200); George T. Cussen, vice president, $13,830.63 salary (up $1,341.63); L. C. Burwell Jr., vice president, $17,332 salary; Frank B. Lynott, vice president, $19,467.39 salary; George M. Messenger, vice president, $12,900 salary; John L. Higgins, assistant vice president, $14,954.88 salary (elected Aug. 16, 1955); L. S. Kimball, vice president, $9,300 salary (elected Dec. 8, 1955).

Also, Frank Benninger, secretary-treasurer, $22,664 salary (up $2,498); O. R. Burghardt, assistant secretary-treasurer, $12,800 salary (elected Feb. 14, 1955); John C. Cosgrove, director, no salary and $100 bonus or indirect (elected Oct. 28, 1955); Norman L. Meyers, assistant secretary, no salary and $100 bonus and indirect; Allen T. Chase, director, no salary, $200 bonus and indirect; James E. Davidson, director, no salary, $300 bonus and indirect; Houston Rehrig, director, no salary, $300 bonus and indirect; Robert L. Smith, director, no salary and $300 bonus and indirect; and William Zeckendorf, director, no salary, no bonus or indirect; Meyers & Batzell, legal counsel, $46,000 (down $2,000).

National Airlines, Inc. G. T. Baker, president and director, $30,000 salary, $64,846 bonus and indirect compensation (up $32,718); C. E. Banks, vice president—production, $12,000 salary (up $6,000), $26,338 bonus (up $24,578); J. C. Brawner, senior vice president, treasurer and director, $14,250 salary (up $2,250), $27,985 bonus (up $14,934); L. W. Dymond, assistant vice president, $9,000 salary, $7,902 bonus (elected Apr. 8, 1955); R. A. Fitzgerald, assistant vice president, $9,000 salary, $3,951 bonus (elected Apr. 4, 1955).

Also, R. P. Foreman, secretary and director, $12,000 salary, $26,338 bonus (up $13,287); A. G. Hardy, senior vice president, $14,250 salary (up $2,250), $27,985 bonus (up $16,991); W. F. Johnston, assistant secretary-treasurer, $11,000 salary, $24,144 bonus (up $12,180); John L. Morris, vice president, $12,000 salary, $26,338 bonus (up $13,287); G. W. Paul, assistant vice president, $9,000 salary, $3,951 bonus (elected Apr. 8, 1955).

W. A. Perry, assistant vice president, $9,000 salary, $7,111 bonus (elected Apr. 8, 1955).

J. M. Rosenthal, senior vice president, $14,250 salary (up $2,250), $27,985 bonus (up $14,934); C. F. Sharp, assistant vice president, $12,000 salary, $23,705 bonus (up $10,754); R. E. Wieland, vice president, $12,000 salary, $26,338 bonus (up $13,272); John W. Cross, director, no salary, no bonus; C. W. Gibbs, director, no salary, no bonus; Burke O. Hedges, director, no salary, no bonus; Edwin C. McDonald, director, no salary, no bonus; Paul R. Scott, director, no salary, no bonus; Daniel R. Topping, director, no salary, no bonus; J. A. Waterman, director, no salary, no bonus; and Bert Winters, director, no salary, no bonus; Cummings, Stanley, Truitt & Cross, legal counsel, $10,592.94; John W. Cross, legal counsel, $36,595.45; Scott, McCarthy, Preston, Steel, & Gilleland, legal counsel, $31,116.17; and Gotch & Crawford, statistical, $23,206.96.

CAB Orders

(Mar. 22-28)

GRANTED:

Flying Tiger Line exemptions to perform transatlantic charter flights pursuant to contracts with United Singers of Philadelphia, Student Assn. of the University of Wisconsin and the Undergraduate Council of Princeton University.

Riddle Airlines an exemption to lease, with an option to purchase, one C-46 aircraft from American Air Export and Import Co. for 18 months.

Leave to intervene in the Lima-Detroit Service Case to Toledo and the Toledo Chamber of Commerce; Detroit and the Detroit Board of Commerce.

Riddle Airlines an exemption to lease and purchase one C-46 aircraft from Miami Aircraft and Engine Sales, Inc.

Transocean Air Lines' petition for separate consideration of its acquisition of control of Air Jordan Co., Ltd.

Colonial Airlines an extension of its exemption authority to serve Philadelphia-Camden on flights between Syracuse and Washington providing no local traffic is carried between Washington and Philadelphia-Camden, until the effective date of the merger with Eastern Air Lines.

Flying Tiger Line an exemption to perform charter flights during May and June, 1956, from Munich, Athens, Brussels, London or Hamburg to New York pursuant to a contract with the Intergovernmental Committee for European Migration.

Riddle Airlines an exemption to carry surface mail to newly authorized points on its domestic Route 120.

APPROVED:

Agreements involving Trans World Airlines, Braniff Airways and various other carriers relating to intercarrier arrangements.

Agreement between various carriers adopted by the International Air Transport Assn. relating to North Atlantic specific commodity rates.

Agreement between various carriers adopted by the International Air Transport Assn. relating to an increase in the first class and tourist fares between Bombay/Karachi and Aden/Nairobi.

Agreements involving Northwest Airlines, Delta Air Lines and various other carriers relating to intercarrier arrangements.

ORDERED:

Investigation instituted to determine whether a temporary local service route should be authorized for Portsmouth, Ohio, between Cincinnati and Columbus and, if so, which carrier should operate it.

Consolidation with the Great Lakes-Southeast Case of National Airlines' amendment 4 to its application. Leave to intervene was granted to Sarasota Manatee Airport Authority, the Sarasota Chamber of Commerce and the Chamber of Commerce of Bradenton, Fla. Petitions for reconsideration of the consolidation filed by Delta Air Lines, Nashville and Nashville Chamber of Commerce were denied.

Applications consolidated into the Puerto Rico Service Case filed by Capital Airlines, Caribbean-Atlantic Airlines, Delta Air Lines, Eastern Air Lines, National Airlines, Pan American World Airways, Riddle Airlines, Trans Caribbean Airways, United States Overseas Airlines and the Commonwealth of Puerto Rico.

Riddle Airlines' and Trans Caribbean Airways' applications consolidated with the proceeding involving the application of Pan American World Airways for a route between San Juan, P. R., and points in Europe. Eastern Air Lines, Trans World Airlines and the Postmaster General were granted leave to intervene in the case.

DISMISSED:

American Airlines' complaint against Trans World Airlines' combination first class-tourist service and the CAB investigation of the service, since American has withdrawn its complaint and provisions have become effective which make a clear distinction between the first class and tourist services.

Midet Aviation Corp.'s application to be designated an air taxi operator, since the carrier has expressed no interest in prosecuting the application.

Investigation of the relationship of rates for varying weight breaks instituted pursuant to complaints of Schlage Lock Co., Enterprise Engine and Machinery Co. and Airborne Flower and Freight Traffic, Inc., since the complainants are found not ready to participate actively in the investigation at this time.

Berth charge investigation, since IATA has instituted a uniform berth charge.

DENIED:

Delta Airlines' and Transportes Aerlos Nacionales' petitions for reconsideration of the CAB order instituting an investigation of whether IATA resolutions restrict interline agreements between IATA airlines and non-IATA airlines..

Petition for reconsideration filed in the reopened Bonanza Renewal Case by Bonanza Air Lines, and motions filed by Bonanza, Southwest Airways, City of Fresno, City of Sacramento and City of Stockton.

North Central Airlines' petition for reconsideration of CAB action in the Lima-Detroit Service Case.

Slick Airways' motion to sever from the investigation of minimum rates for air freight forwarders the issue of whether air freight forwarders should be brought under the present minimum rate order.

Application of Monroe and West Monroe, La., for exemption authority to permit Southern Airways to operate between Monroe and Houston via Lake Charles and Alexandria.

EMPLOYMENT OPPORTUNITIES

NATIONAL COVERAGE

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant	Civil Service Opportunities	Employment Agencies
Positions Wanted	Selling Opportunities Wanted	Employment Services
Part Time Work	Selling Opportunities Offered	Labor Bureaus

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Subject to Agency Commission.

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Position Wanted Ads are ½ of above rate.
Box Numbers—counts as 1 line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
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Send NEW ADS to AVIATION WEEK, 330 W. 42nd St., N. Y. 36, N. Y., for April 23rd issue closing April 12th.

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M.E. or A.E. Degree

Minimum 5 (5) years Aircraft Experience on Material Review Board and Liaison with Shop. Capable of initiating requests for Design Changes.

Unusual opportunity for qualified engineer with airframe subcontractor on military aircraft. State salary expected and date availability.

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PILOTS FOR OVERSEAS ASSIGNMENT

Minimum First Category requirements 5000 hours at least 100 hours command time. ATR and DC-3 Type Rating. Minimum Second Category Requirements 800 hours solo time. Commercial licenses, multi-engine and instrument rating.

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Personnel Office, Hangar #5, Oakland Municipal Airport, Oakland, California

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We are looking for a radio man or radio engineer capable of setting up and operating top CAA approved facility. Our customers are large corporations, airlines, etc. We prefer a man now doing such work who is familiar with custom installation. This is a wonderful opportunity for the right man. All replies will be answered. Florida location. Reply to

P-1313, Aviation Week
330 W. 42 St., New York 36, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

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Analysts——Traffic & Economics. Executive offices in eastern city. Age 25-35 preferred. P-1155, Aviation Week.

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Pilot 1500 hrs. Rotary. 1500 hrs fixed wing accident free. CAA Comm Lic. Multi and single eng land, helicopter. Two yrs helicopter instr. allconfigurations. Age 32 available immed. PW-1182, Aviation Week.

Ex-Superintendent of Maintenance, Flight Engineer and Maintenance Foreman, A & E license, desires N. Y. area. 18 yrs. experience all types airline aircraft. Top references. Prefer maintenance, supervisory or aircraft and engine instructing. No flight duty. PW-1250, Aviation Week.

Navy Research and Design Officer, M. I. T. Creative engineer & design certificate, inventor jet convertiplane patent applied for, creative consultant position desired. PW-1253, Aviation Week.

Commercial pilot, instruments 500 hrs. and flight engineer 4500 hrs. License DC-6B. 35 years, married. All offers considered. PW-1303, Aviation Week.

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Aircraft Corporation
Georgia Division

Has immediate openings for:

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Engineers needed to investigate and develop new aircraft standards, coordinate information on type and characteristics of specific products, quantity requirements, production problems, nature of demand and source of supply. Should be capable of insuring that required proof tests are run and should be able to determine effect of proposed standards on company design and shop practices.

M.E., A.E., or E.E. degree plus minimum of 2 years experience in standards work required.

Write in complete confidence to

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LOCKHEED AIRCRAFT CORPORATION

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P-1240, Aviation Week
330 W. 42 St.,NewYork 36, N. Y.

engineers ANNOUNCING EXPANSION OF THE ROCKET ENGINE SECTION of General Electric's Aircraft Gas Turbine Development Department

The performance records of rockets as power plants for supersonic missiles and aircraft have led to accelerated design and development activities in this field. Our huge satellite program is now under way. Engineers who wish to contribute to advances in propulsion will be interested in the following openings created by expansion at GE.

ROCKETS

- Design and develop rocket engine valves, seals and piping. Establish and maintain standards and instructions for their manufacture, test, installation and operation.
- Design, develop, construct and test rocket engine seals and piping. Prepare standards and instructions for their manufacture, test and use.
- Assemble and test rocket engines from their functional components. Design and develop supporting members needed to mount engine components.
- Design, develop, construct and test propellant pumps.
- Design, develop, construct and test turbines. Conduct performance analysis.
- Create advanced inlet designs for high performance rockets; provide data on aerodynamic design and performance of such inlets, and conduct theoretical and experimental investigations of designs created.

You'll be working with top men in the field, in small groups which stimulate exchange of ideas. Here, your talents can be easily recognized and rewarded. Educational assistance programs and specialized technical courses are also available to you.

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CINCINNATI 15, OHIO
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Here you will encounter instrumentation problems that challenge the state of the art and stimulate your creative ability in Aero, Ballistic and Space techniques.

Specific fields include:

TELEMETRY
RADAR
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Your rewards will include all the fascination, excitement and satisfaction of achievement in new frontiers of scientific knowledge . . . plus top salary.

What's more, you'll enjoy the pleasant climate and ideal living on Florida's central east coast, where Patrick Air Force Base, site of the MTP, is located.

RCA offers many additional advantages: Complete facilities . . . Planned advancement program . . . Professional recognition . . . Liberal program of company-paid benefits . . . Relocation assistance. You should have a Bachelor's or advanced degree in EE, ME, Physics or Mathematics and two or more years' experience.

Request Your Interview **NOW...**

RCA Engineering management will arrange an interview at the time and place you find most convenient. Please send complete resume of education and experience to:

Mr. H. N. Ashby, Technical Employment
Missile Test Project, Dept. N-5D
RCA Service Company, Inc., P.O. Box 1226
Melbourne, Florida

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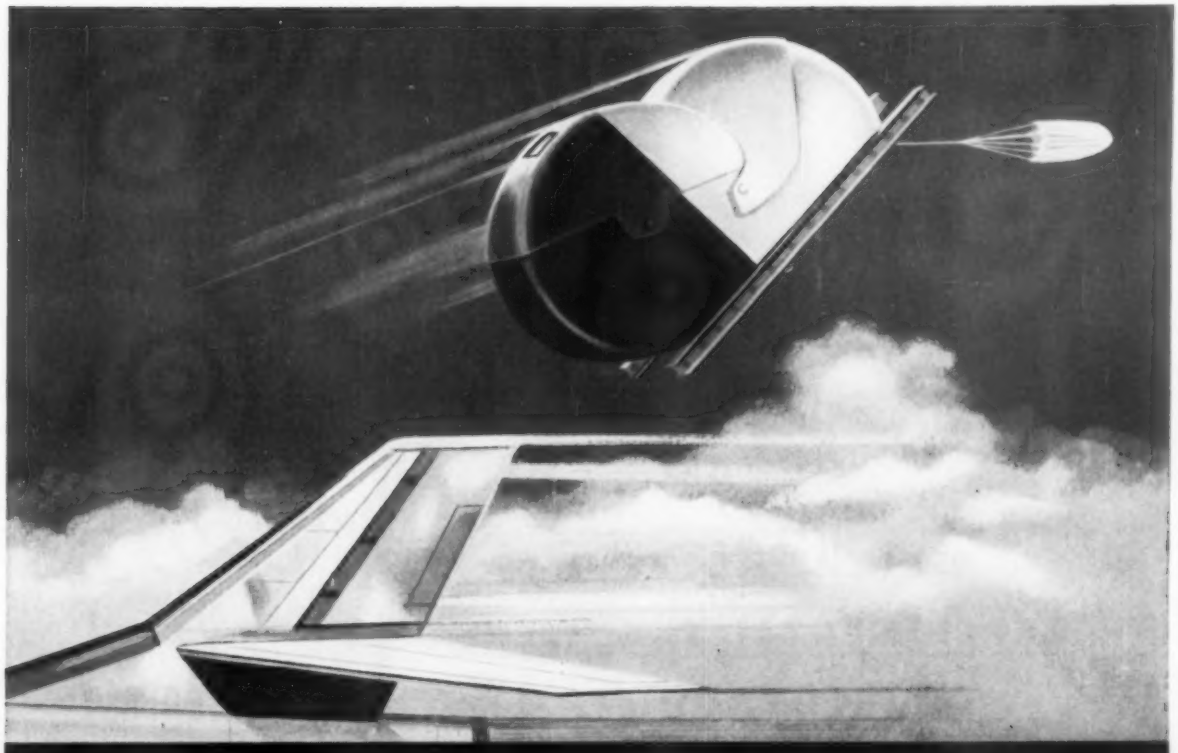
RADIO CORPORATION of AMERICA



The proof of the pudding

Not long ago this long-needed, lightweight escape capsule for jet aircraft was merely an idea in the mind of an enthusiastic engineer. Today it is a long awaited reality which will give our pilots added assurance and safety on their important missions as our nation's defenders. What turned this "hunch" idea into a realistic accomplishment? The answer is creative engineering —our specialty at Goodyear Aircraft—where transforming ideas into working realities has become a habit.

Here ideas are a prime commodity. Imagination and ingenuity are our raw materials. And to help put their ideas to work, our engineers have the most modern facilities available, including one of the world's largest computer laboratories. Here, *every* idea has a chance.

And many of them make the grade, as the record will show. Both in peace and in war, our engineers have turned their ideas into significant accomplishments that benefit nearly every aircraft in our skies. Airships, missiles, electronic guidance and computing equipment, structural materials, plastics—the list is long and broad. And it's still growing.

This continued growth and diversification demand that our engineering staffs be expanded both at Akron, Ohio, and Litchfield Park, Arizona. Opportunities are unlimited for creative engineers in all specialties. So, if you have faith in your ideas and confidence in your ability to make them work, there's a challenging career waiting for *you* at Goodyear Aircraft.

Salaries and benefits are, of course, liberal. And if you wish to continue your academic studies, company-paid tuition courses leading to advanced degrees are available at nearby colleges.

For further information on *your* career opportunities at Goodyear Aircraft, write:
Mr. C. G. Jones, Personnel Department, Goodyear Aircraft Corporation, Akron 15, Ohio.

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Outstanding openings now for qualified

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Applicants with BSME or AE plus 3 or more years experience are preferred. Inquire *now* for responsible positions in our rapidly expanding programs in gas turbines and airborne controls. Replies will be kept confidential. Write, giving resume, to *DALE A. COBB*, Department A-128.

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An engineer worth up to $15,000 will welcome this opportunity to progress

SYSTEMS ENGINEER—

perform complex systems analysis, synthesis and development of major weapons systems.

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Join an engineering team at top level, working on a highly creative project with an electronics pioneer.

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***To arrange confidential interview, send resume to**

P-9536, Aviation Week
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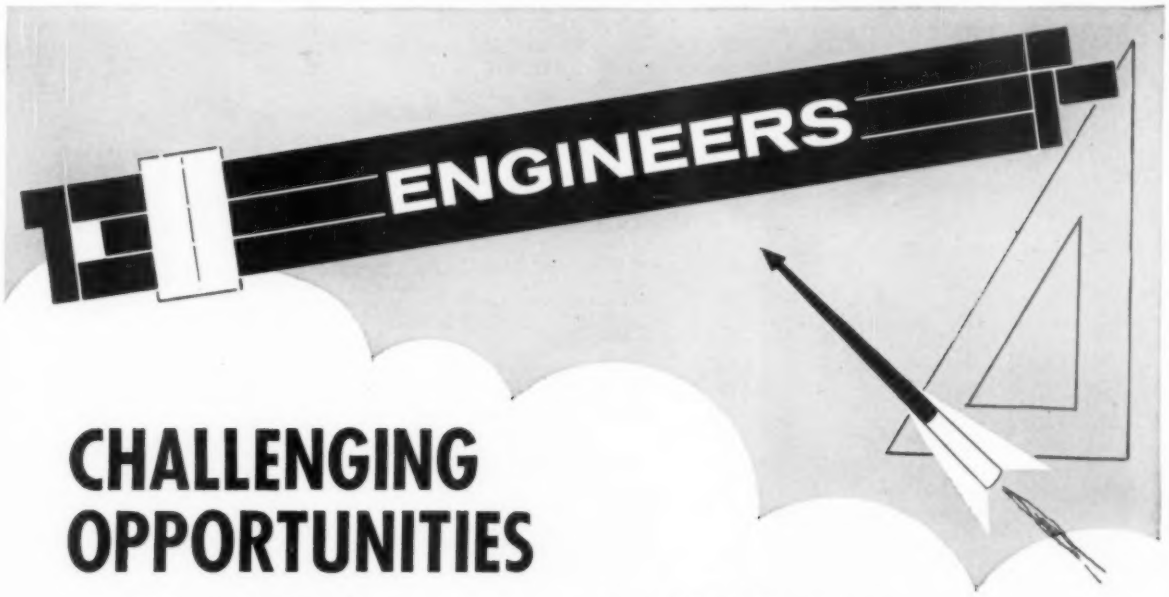

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IN • Avionics • Inertial Systems
• Computers • Missile Guidance
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ALL GRADUATE ENGINEERS are offered permanent job opportunities. We extend a cordial invitation to every deserving Engineer and Designer to write us their wants. We may be able to supply the square hole for the square peg!

YOUR FUTURE depends on your making the right connection with the right firm as quickly as possible.

The men hired will enjoy working with some of the top men in the field and with the finest test, research and development facilities. GM's long-standing policy of decentralization creates individual opportunity and recognition.

Why not send us full facts about your education, work background, etc. We will do all we can to treat your application with the fullest confidence.

AC SPARK PLUG — THE ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION
MILWAUKEE 2, WIS. — FLINT 2, MICH.

WANTED:

Electronic and Mechanical Engineers at

Bendix-Pacific

This is the new Engineering Center at Bendix-Pacific now nearing completion. With 100,000 square feet of area, it represents the latest and one of the most complete engineering facilities in the nation.

You are invited to consider becoming a member of this vital engineering group—with a forward looking company in Southern California.

Unusual engineering positions in electrical and mechanical design of radar, sonar and telemetering are available. These positions, which are directly associated with our long-range projects for industry and for defense, are available at all levels.

Please fill in the coupon or write us for complete information.

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Pacific Division, Bendix Aviation Corp.
11600 Sherman Way, North Hollywood, Calif.

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I am a graduate engineer with _____ degree.

I am not a graduate engineer but have _____ years experience.

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INERTIAL NAVIGATION

Immediate openings for **Supervisory and Staff** *positions as well as for*

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SYSTEMS EVALUATION
GYROSCOPICS
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THERMODYNAMICS
OPTICS
ENVIRONMENTAL RESEARCH
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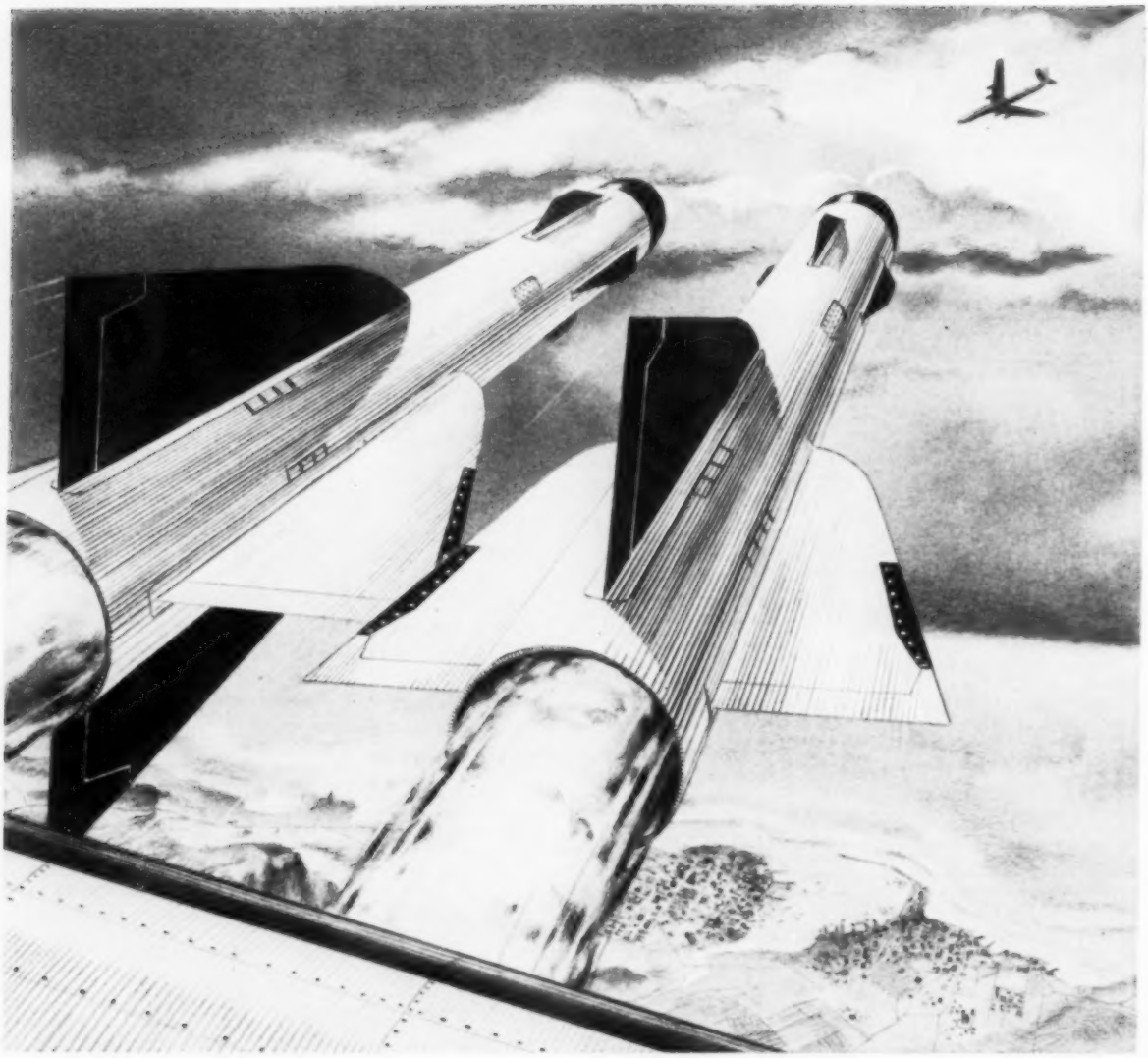

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LETTERS

New Air Policy

I have been a regular subscriber to your magazine for several years, and I genuinely feel that you are performing a literary service of inestimable value to the nation—air age education.

In this respect, I feel compelled to comment on a recent article contained in Washington Roundup (March 5, 1956) which forecast continuance of the present National Air Policy. It struck me that this rather unobstrusive statement could well contain the key to our future survival—providing steps could be taken to make the forecast inaccurate.

There is abundant evidence that we are presently at peace with the Communists only because of our overwhelming superiority in offensive and defensive air power. However, because of a reluctance to change our traditional and outmoded national weapons system, we are fast losing this "superiority" by permitting a state of offensive parity to be reached between our forces and those of the USSR. It is believed obvious that our only practical hope for continued prevention of total war with the Communists lies in our continued maintenance of superiority in offensive and defensive air power.

Need for New System

To do this most effectively, a New National Weapons System must be developed to replace our present out-dated military system which is still largely based upon the World War II trinity of land, sea and air forces. A military system for a modern world power must revolve about air-nuclear power. The enunciation of a current National Air Policy is the first step in this direction.

It has been nine years since a comprehensive review of United States air power was made.

As you well know late in 1947 President Harry S. Truman appointed an Air Policy Commission headed by Thomas K. Finletter, which was to recommend an integrated National Air Policy for the United States which would (1) protect the nation's security to the greatest extent possible and (2) foster the nation's economic and social interests.

In retrospect, this Air Policy served as the modern basis for the development of our current air-nuclear power. It also served to help defend the heavy bomber strategic force concept against the "admirals' attack" in 1949. The policy provided a new strategic concept for the application of military power (in effect, capacity for massive retaliation). Finally, through its searching and impartial investigations, the Finletter Commission saw and gave warning of the looming threat of Communist atomic striking power at a time when the majority of our government and military leaders ridiculed the nearness of the threat.

Threat of Future

The boldness and vision of the report are quite remarkable in retrospect. This 1947 Air Policy gave guidance to the planning and the development program which resulted in today's modern U. S. Air Force—the principal preserver of peace in the world.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

However, it is now urgent that we renew this policy. In its original form it was to provide security for the nation and its foreign commitments through 1955. This was modified in 1953 by a policy which stretched out the final attainment of the force levels to 1958. This policy was based in part on facts and assumptions declared in 1953.

Many of the assumptions are now known to be erroneous. We can no longer ignore the advances in technology and enemy capabilities. The force we intended to have in 1955 and then delayed until 1958 clearly will not serve to meet the known threat we face in 1958.

In recognition of the dynamic nature of airpower, and its recent affiliation with thermonuclear fire power, it is time for a sweeping review of all aspects of United States Airpower. From such a review, a new National Air Policy can be derived. Such a policy is urgently needed to free the halting advance of United States Airpower, for even today, its progress is being metered and delayed by the current unlogical system of defense budget division.

An up-to-date National Air Policy is needed to awake and educate the public to the facts of air age survival; to provide answers to the traditionalists and sloganeers who counsel against placing faith in modern strategies and weapons but would compromise for "balanced forces."

A National Air Policy would lend courage and support to our Congressional and military leaders who are earnestly seeking to provide the nation with an effective National Weapons System geared to the age in which we are living. Such a policy will serve as a basis to commence the redesign of our military system so that it may effectively met the responsibilities in the air-nuclear age.

'Undiminished Progress'

Finally, a current National Air Policy announced for the United States would serve notice to Soviet Russia and Red China that U. S. foreign policy will be served and supported by the only element of U.S. military force that they fear—our air-nuclear power. Further, that this deterrent to war will constantly be improved in the years that lie ahead and our superiority in this element of force will not be allowed to diminish.

On the contrary, it will be strengthened, modified and continually replaced as the creative thought and effort of the best of our scientific, technological and industrial personnel respond to the requirements placed upon them by modern air planners.

The promise of such undiminished progress for airpower, unhindered by tradition and backed by the resolute action and support of our government, will certainly give the Communist war planners reason for pause, to think twice before scheduling a date for any future conflict.

In consequence, such a policy would afford the guidance and principles that must precede U. S. airpower progress in the dawning air age and, under foreseeable circumstances, will offer the only means of continuing the peace and insuring our survival as a nation.

There is some talk of appeasing the decriers of present defense policy by granting the construction of a few more B-52s and possibly granting more funds for missiles and base construction; however, it should be clear that such steps are not guided and fortified with an unequivocable policy to maintain superiority in offensive and defensive air-nuclear weapons.

I suggest that you could help to bring about the establishment of such a policy through your editorial pages. It would be a positive step toward making your previously mentioned forecast inaccurate.

NAME WITHHELD

Tribious, Triphibious?

In recent years the word "triphibious" has crept into our vocabulary and has occasionlly appeared in AVIATION WEEK.

I presume, because of its general use, this word has now gained eligibility status for inclusion in standard dictionaries. However, because of my Greek descent and natural inclination to correct etymology, I desire to enter my objections.

The word "amphibious," as you well know, is derived from the two Greek words: "amphi" which means "both" and "bios" which means "life." Therefore, the word "amphibious" applies to creatures which can live in both environments, on the land and in the water. If we want to designate a creature that can live in the three elements, land, air and water, we should call them "tribious" and not "triphibious."

The person or persons who first coined the word "triphibious" evidently were not up on their etymology.

C. D. TRIPOLITIS
Chief Engineer
Department of the Navy
Bureau of Aeronautics
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Los Angeles 15, California

Orenda 14 Not Avro

I would like to draw to your attention the wording in your column "Industry Observer," page 23, March 5, 1956 issue. In the item beginning "Canadair Limited, Montreal," the engine concerned is the Orenda 14, manufactured by this company, and there should be no use of the word Avro in describing this engine.

SCOTT YOUNG
Assistant to the General Manager
Orenda Engines Limited
Toronto, Canada

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